

PUBLIC WORKS

City, County and State

1918



BEFORE completing your 1937 road plans, talk your problems over with the Tarvia field man. He represents America's oldest and most experienced manufacturer of coal-tar road-building materials. His special training plus your own knowledge of local conditions may result in more miles of good road on next year's budget. Tarvia types combine ease, economy and speed in construction and maintenance operations—assure the maximum mileage of durable, easy-riding, skid highways from road funds available. Phone, wire or write our nearest office.

1936

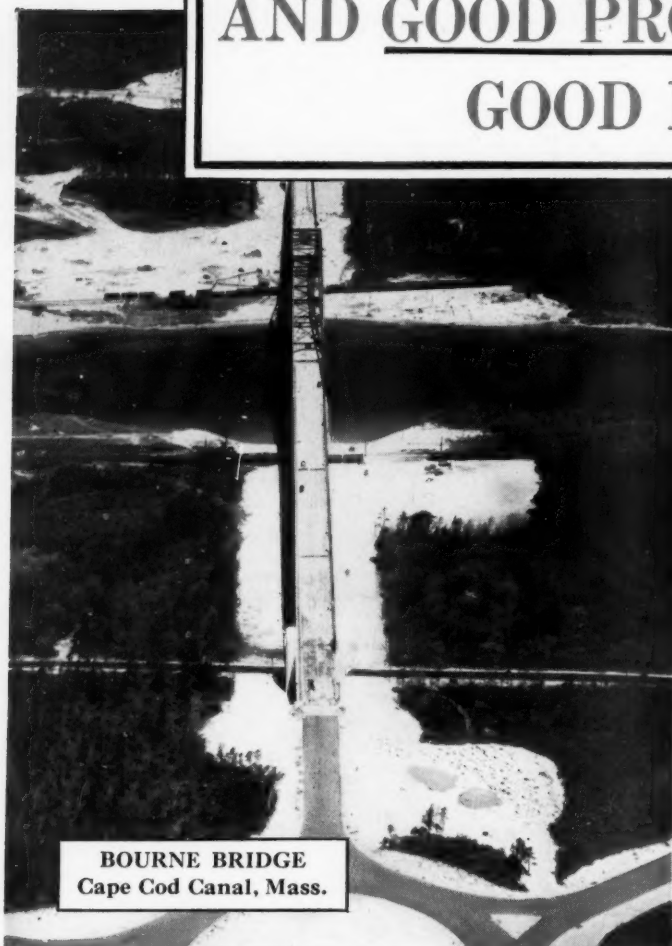


Marquette-Negaunee Road, Marquette County, Michigan. Tarvia since 1918. Highway guard rails and a traffic line have been added but the Tarvia road is as smooth, easy-riding and skid-safe today as it was eighteen years ago.

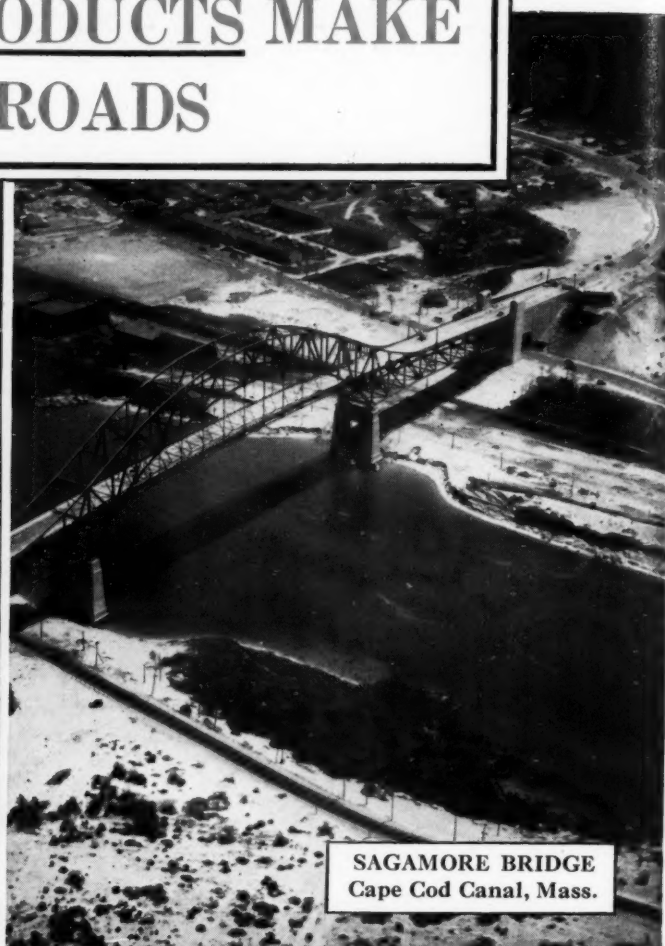
THE BARRETT COMPANY New York Chicago Birmingham Philadelphia Boston St. Louis Cleveland Minneapolis
 Lebanon Milwaukee Detroit Baltimore Columbus Youngstown Toledo Buffalo Providence Syracuse Hartford Cincinnati
 Bethlehem Rochester Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

DECEMBER, 1936

GOOD ENGINEERING AND GOOD PRODUCTS MAKE GOOD ROADS



BOURNE BRIDGE
Cape Cod Canal, Mass.



SAGAMORE BRIDGE
Cape Cod Canal, Mass.

Socony Asphalt over a mop coat of Socony Waterproofing Asphalt, Standard Brand, Bourne Bridge (left), Sagamore Bridge (right), Cape Cod Canal, Mass.

Photos by 101st Photo Sect., 26th Div. Aviation, Mass., N. G.

Socony Asphalt Road Oils · Socony Asphalt Joint Fillers · Socony Waterproofing Asphalt · Socony Cut-Back Surfacing Asphalt · Socony Asphalt Binder A for surface treatment · Socony Refined Asphalt for sheet asphalt paving · Socony Cold Patch Asphalt for all types of patching · Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) · Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) · Socony Asphalt Emulsion for Surface Treatment, Penetration, Road and Plant Mix, and Patching · *Specifications and all other particulars furnished on request.*

SOCONY-VACUUM OIL Co.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION



PUBLIC WORKS

City, County and State Engineering
and Construction

DECEMBER, 1936

VOL. 67, NO. 12

Contents

EDITORIAL 19

HIGHWAY CONSTRUCTION AND MAINTENANCE:

Improving Sheet Asphalt Design.....	10
Traffic Line Painting on Rhode Island State Highways.....	13
Safeguarding Winter Danger Spots.....	13
Roadside Development for Counties. <i>By F. M. Guirey</i>	14
Dust Storms and Mid-West Highways. <i>By Ben L. Allen</i>	18
U. S. Forest Service Experiments With Stabilized Roads.....	24
Rhode Island State Highway Curb Design.....	34
Operation Data on Concrete Pavement Breaking.....	34
German Soil Research in Road Construction.....	36
Mud-Jacks Eliminate Road Dips.....	40

SEWERAGE AND SANITATION:

The Mogden, England, Sewage Treatment Works.....	11
Repairing and Lining an Old Sewer in Indianapolis. <i>By M. G. Johnson</i>	17
The Digestion Tank.....	30
Malaria Control in Impounded Waters.....	38
Los Angeles County Sanitation Districts Ocean Outfall Sewer.....	41

WATER SUPPLY AND PURIFICATION:

Experimental Work in Water Shed Management.....	9
Laying Water Mains in Four Feet of Frost. <i>By Lee Hawley</i>	12
New Industrial Water Supply System at Birmingham. <i>By A. C. Decker</i>	20
Suggestions for Designing Swimming Pools.....	23
New Soft Water Plant for Arcadia, Fla.....	24
The WATER WHEEL.....	26

CONSTRUCTION AND NEWS:

All of Schenectady County's Main Highways Lighted.....	10
Town and Local Gasoline Taxes Unprofitable.....	16
Diversion of Highway Funds a Maine Issue.....	18
Diversion of Road Users' Taxes.....	25
Testing Bearing Capacity of Piles.....	37
Lubrication Plan for Canal-Digging Equipment.....	40

DEPARTMENTS:

New Equipment and News.....	45, 49, 50
Book Reviews.....	44
Readers' Service Section.....	51
The Engineer's Library.....	54

TIMEWASTERS

Tut, tut, Mr. Bevan:

In sending in the highly esteemed problem about the train accident, Mr. Bevan attached the wrong answer, thereby causing us much mental anguish, until Mr. Blunk and Mr. Aldridge, among others, corroborated our findings. Yes, the train trip was 88.88888 miles long, the scheduled speed of the train was 22.22222 miles and the schedule time, of course, was 4 hours. It was a good problem, though, and we thank Mr. Bevan just the same.

The Ikey and Mikey Olympic tests proved that Ikey could reel off a mile in the fast time of 7 minutes; while Mikey couldn't do a bit better than a mile in 8 minutes.

That seems to cover the solutions to the problems in the November TIMEWASTERS. Now for some new ones to last over until next year.

The Dog and the Fox:

A hound that had proved its ability to smell a fox at 1100 yards, but no farther, was riding on the running board of an automobile going due south on a paved road at 75 miles per hour. When the car carrying the dog was exactly one mile north of a fox trail that crossed the road at right angles, a fox crossed the road running due east at the rate of 60 miles an hour. If both the automobile and the fox maintain their respective speeds, for what length of time, if any, will the dog be able to smell the fox?

Now, if you solve that, you might as well go on and find out what the shortest distance between them will be, and when it will occur.

That brainbuster and timewaster was contributed by Mr. Blunk.

An Alphabet Problem:

In what time will A, B and C together do a job if A alone could do it in 6 hours more, B alone in 1 hour more and C alone in twice the time? Contributed by John Bevan.

With best wishes for a Merry Christmas and a Happy New Year to all. W. A. H.

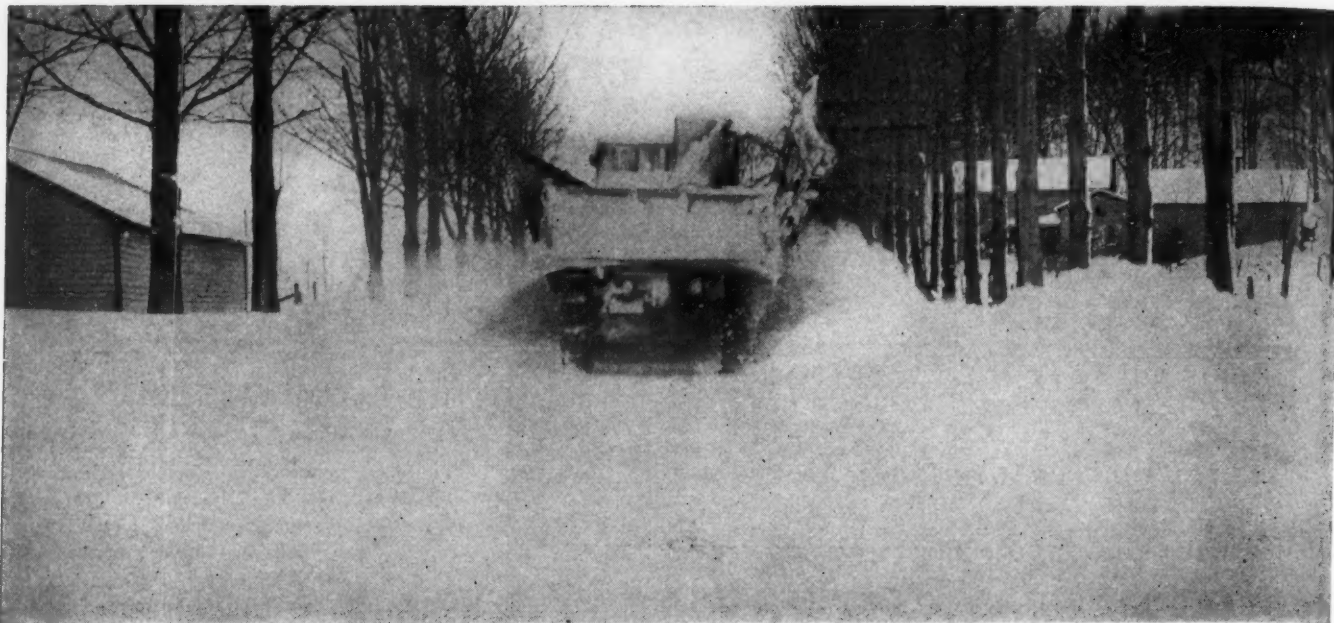
SUBSCRIPTION RATES: United States and Possessions, Canada, Mexico and Cuba, \$3.00. All other countries, \$4.00. Single Copies, 35 cents each.

A. PRESCOTT FOLWELL, Editor

W. A. HARDENBERGH, Asso. Editor

Published monthly by the PUBLIC WORKS JOURNAL CORPORATION, 310 E. 45th St., New York, N. Y. J. T. MORRIS, *President*; W. A. HARDENBERGH, *Vice-Pres.*; CROXTON MORRIS, *Treasurer*. Advertising representatives, S. N. HUME, 310 E. 45th St., N. Y.; FRED R. JONES, 228 No. La Salle St., Chicago, Ill.; ALONZO HAWLEY, 1635 E. 25th St., Cleveland, Ohio. ARTHUR K. AKERS, 244 Tutwiler Hotel, Birmingham, Ala.

FOUNDED IN 1896



Just A Minute! . . .

The Roads Are Being Opened By

FRINK SNO-PLOWS

There's no long waiting for traffic arteries to be opened when your equipment includes Frink Sno-Plows. A couple of minutes after the snow alarm sounds, the Sno-Plows are hooked in place, the trucks are out on the highways, and the snow is being thrown and spread at the sides . . . at a speed of 15 to 35 miles per hour! Truly you can say "just a minute"—and the roads will be open for traffic.

Frink Sno-Plows are big . . . strong . . . powerful . . . rugged . . . fast. They fit all standard makes of trucks. They are easy to handle. They are adaptable to all snow conditions. Above all, they are *thorough*, removing even the traffic-packed and frozen snow that ordinary plows ride over.

Made in 12 standard sizes, they make it unnecessary for you to overload or underload your trucks. For full justice to yourself, your motorists and your tax-payers, you should know all about Frink Sno-plows. You will find the facts interesting. They are all contained in catalog 36 AP. Send for it today.

SPECIAL FEATURES

PUSH EASIER—at higher speeds less power consumption.

NO SIDE THRUST—the snow is raised on the inclined portion of the moldboard.

SELF BALLASTING—the snow acts as ballast preventing the front wheels from slipping sideways.

BEVEL SIDE BANKS—preventing the snow from falling back into the cleared path.

WILL NOT WEDGE—no matter how hard they hit the snow bank.

WILL NOT BUCKLE—driving power is applied directly to the cutting edge . . . not to the back of the Sno-Plow.

LIGHT YET RUGGED—do not overload the truck with dead weight.

NO UNSPRUNG WEIGHT—when lifted for moving from job to job, the entire weight is carried above the truck springs.

SAFE AT HIGH SPEEDS—snow does not fly up onto windshield to interfere with driver's vision.

HAVE NOSE ICE PLATES—interchangeable with regular nose shoe for use when snow is tightly packed or frozen.

ADJUSTED WITHOUT TOOLS—exclusive, patented Frink Heel Adjustment permits changing height of cutting edge by one man—no tools.

QUICKLY ATTACHED AND DETACHED—insert two drive pins, hook up three chains . . . and the Sno-Plow is ready for tough, fast service.

HAND OR POWER HYDRAULIC—you can select either type you prefer.

CARL H. FRINK, MFR.

CLAYTON

• THOUSAND ISLANDS •

NEW YORK

DAVENPORT BESLER CORP., DAVENPORT, IOWA

FRINK SNO-PLOWS of Canada, Ltd., Toronto, Ontario

PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 67

December, 1936

No. 12

Experimental Work in Watershed Management

AN EXTENSIVE twenty to thirty-year experiment has recently been inaugurated in Southern California centering in the San Dimas Experimental Forest, with its approximate 17,000-acre area inclusive of the Big Dalton and San Dimas Canyons drainage basins that are tributary to the San Gabriel Valley, with the definite objective of determining the best method of management for chaparral-covered watershed areas so that a maximum amount of water may be obtained with a minimum of erosion. This work, as time progresses, will no doubt yield much information that will prove invaluable in other areas.

Southern California has progressed rapidly in the past fifty years and her agriculture and industry alike are taking an increasing toll upon the natural water supply. Naturally in such a semi-arid region, the quantity of usable water is of paramount importance to the development of all the resources within that territory. So acute has the shortage become in Southern California that it has been necessary to import water into the regions of development. This has, of course, resulted in not only a higher water rate, but also a curtailment in the use of water in all phases of life and activity. Over a period of time, such curtailment would have a tendency to slow up development, and this is particularly true in the case of agricultural interests.

At times, rainfall in Southern California reaches torrential proportions and unless adequate facilities are established for its storage, it will continue to flow or drain down to the ocean. The flood-hazard to both prop-

erty and lives then becomes no mean consideration. Other disastrous effects are created. Silting of both storage and flood control reservoirs and the clogging of gravels in water spreading grounds, during such storm periods, result in increased damage from major run-offs.

The principal problems in watershed management in such areas pertain to flood control and the checking and the attempted elimination of the attendant soil erosion. Erosion is naturally greater when the vegetation in the mountains has burned over, and it is also greater following upon road construction or other major soil disturbing factors. It is an established fact that vegetation is essential to minimize erosion, but, unfortunately, it is itself a big consumer of water. In Southern California therefore it is necessary to determine a method whereby the amount of usable water may be increased. A wide and far-reaching study is now being made into the systematic management of the watersheds with special reference to their vegetation.

The watersheds of the San Gabriel, San Bernardino and San Jacinto ranges supply a large proportion of the local water available to Southern California. Inasmuch as the areas involved in the present survey are largely within the National Forests, the United States Forest Service is directly interested in their management for maximum productivity. At the present time, the California Forest and Range Experiment Station is making a comprehensive investigation of the problems connected therewith.

A quantitative determination is being made regard-



Flume in main fork, San Dimas Canyon. A modified Parshall flume with 30 ft. throat, one of the largest in the world.



Bell Canyon dam No. 2, showing reservoir full of water and flume.

Photos by U. S. Forest Service

San Dimas Experimental Forest, California

ing the relationship of chaparral vegetation to the yield of usable water, and of its function in reducing erosion. Experiments are also under way to develop management methods so that a maximum of usable water may be obtained from the mountain watersheds with a minimum of erosion.

To arrive at a satisfactory solution of these major problems will take many years. It is necessary that the exact amount of precipitation on the mountain drainage basins be known. The measurement of the water and debris yield from typical watersheds with different types of vegetative covering and an analysis of the vegetative covering in so far as water losses and erosion are concerned is also being undertaken. Another angle from which the problem is being attacked is that of determining the amount of water consumption by native chaparral as well as that of other vegetation believed suitable for alternative planting. Finally, a quantitative determination of environmental factors which affect water consumption by vegetation is also in progress.

Major and intermediate watersheds, varying in area from one to fourteen miles, have been equipped with 370 rain gauges on contours at varying elevations. Fifteen intensity rain gauges have also been set at strategic locations, and these automatically record the rate and amount of precipitation.

Streamflow, resulting from rainfall, is measured at the mouth of each of the intermediate watersheds with

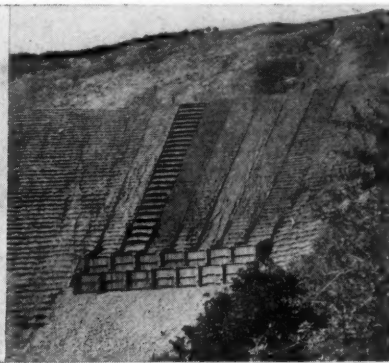
control flumes of various sizes for flood flows, and with 90° V-notch weirs for ordinary flows.

Naturally, surveys have been made of the Big Dalton and San Dimas reservoirs, and subsequent surveys will indicate the quantity of debris deposited.

The factor of vegetation is isolated by differing treatments in a group of small multiple watersheds. These basins have more elaborate equipment than is installed in the intermediate watersheds. A concrete dam and a concrete-lined reservoir has been built at the mouth of each of these small watersheds to catch the debris eroded, while a 30 ft. control flume and a 90° V-notch weir measure the run-off.

Small plots, both denuded and under normal growth conditions, have also been established so that the surficial run-off and erosion may be charted. The effectiveness of different methods of road-fill fixation for erosion control due to road disturbance is also being tested.

Meteorological stations have been established at strategic points, and when the chain of them is finally completed, data will be available from the valley floor to the timber-line. Instruments have been installed which will give a detailed picture of the climatic and soil environmental factors, air and soil temperature, wind direction, etc., so that gradually a basis for correct watershed management will be achieved, once all the research has been accomplished and the data so gained have been correlated and applied.



Left — Big Dalton flood control reservoir, showing multiple-arch dam 175 ft. high.

Right — Volle Canyon erosion control plots. Side walls of upper bins have been extended and lower 30 ft. of metal stripping has been replaced with sheet piling.

Photos by U. S. Forest Service

Improving Sheet Asphalt Design

Improvements made in the design of sheet asphalt pavements in Rhode Island include the use of thicker bases and a system of crack control which will limit the development of surface cracks. This is the first attempt of the state to radically change the design of a type of pavement which has been in use locally for over a period of forty years. Many of the older sheet surfaces have cracked under traffic into small sections that remind one of a field of ice-cakes. Although still usable, these roads present a rather unsightly appearance. It is hoped that the new design will correct many of the defects now apparent in the old pavements and result in much lower maintenance costs.

This "crack control" experiment consisted of the installation of sheet metal plates in the base course and the insulation of the base course from the curbing and around structures by means of prepared and preformed joint filler material. The spacing of the metal plates varied from twenty to thirty feet longitudinally between the plates which were placed vertically and transversely in the base from a center joint to the curb. Results to date have confirmed expectations. At and below the critical spacing which appears to be twenty-five feet, it is difficult to detect any cracking

in the surface course at the plates and none at all between them. When spaced well over twenty-five feet there is perceptible cracking at the plates, but the cracks follow the line of the plates and do not meander all over the surface. There is no cracking between plates even at the thirty feet spacing. — *Annual Report of State Department of Public Works.*

All County's Main Highways Lighted

With the placing in operation in September of 18 miles of sodium lighting on Route 7, leading into the city of Schenectady, following the placing on over 5 miles of the Balltown road of a new safety-lighting system designed by General Electric engineers, Schenectady County, New York, now has approximately 60 miles of highway lighting in operation, which includes all the main highways.

The 18 miles of sodium lighting is the largest single stretch of such lighting in the world and contains 391 G.E. 10,000-lumen units mounted about 250 ft. apart on alternate sides of the road except on curves, where they are all on the outside. The 231 incandescent luminaires on the Balltown road are of special design and use the new 400 cp. tubular half-inch bar filament incandescent lamps. They are staggered 125 ft. apart.

The Mogden, England, Very Complete Sewage Treatment Works

A SYSTEM of main drainage and sewage treatment for the 2,000,000 population occupying sixteen communities in 160 square miles of the West Middlesex district, England, costing £ 5,500,000, was officially placed in service on October 23, 1936. Half the cost was covered by a Government grant and the remainder by a district tax. Of the total amount, the sewers have cost £ 3,150,000.

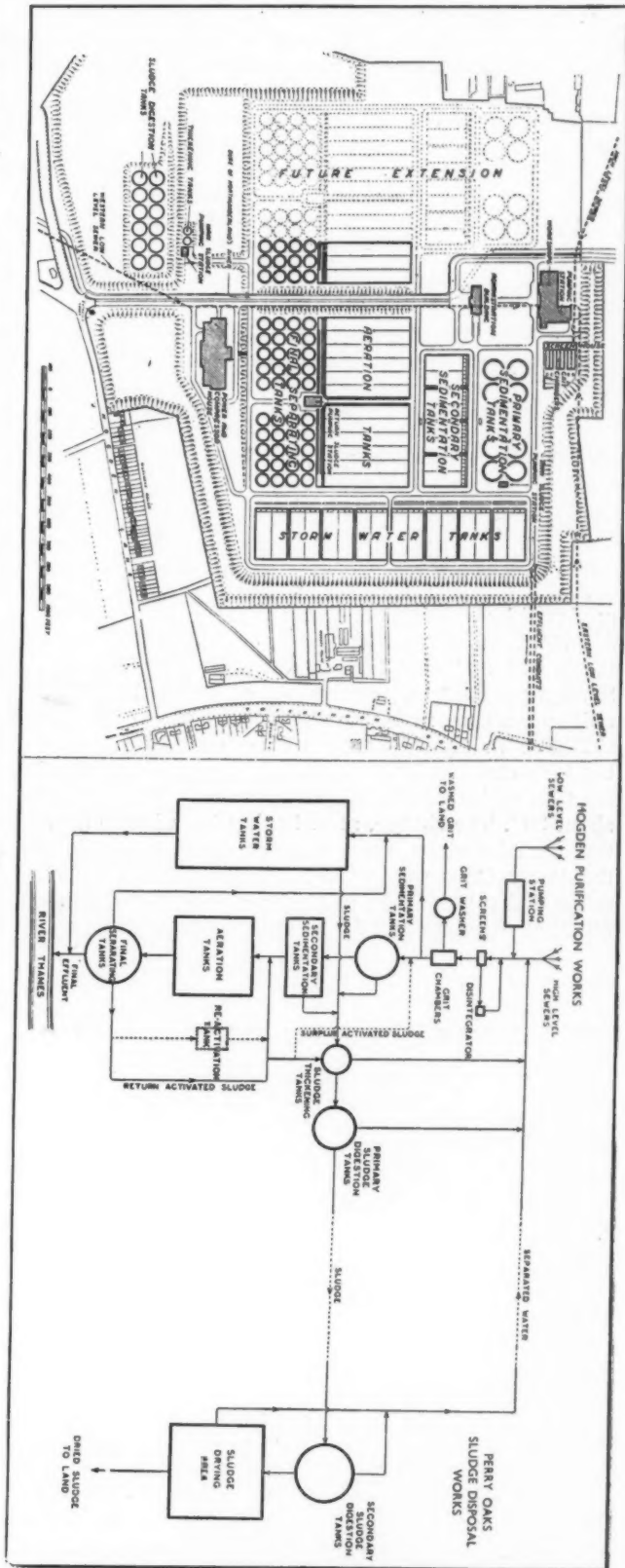
The daily dry-weather flow is estimated at 40 gpd per capita, and provision is made for six times this amount of wet-weather flow, with a maximum rate of 575 mgd. (All gallons in this article are English gallons, equal to 1.2 U. S. gallons.) The site used for the treatment plant contains 150 acres, but the present plant occupies only about 45 acres.

Treatment is by the activated sludge process, using compressed air, preceded by screening and grit removal and sedimentation, and the sludge is thickened and digested. Complete treatment will be given to three times the dry-weather flow, and sedimentation only to all over that; no unsettled sewage will reach the river. About 25% of the sewage will be pumped a height of about 50 ft.

There are six screening and grit-removal units, each with a maximum capacity of 95 mgd, brought into operation in succession by means of automatically controlled hydraulic penstocks. The racks have bars spaced 4", cleaned by manually operated mechanical rakes. The screens have a bar spacing of $\frac{3}{4}$ " and are cleaned by electrically driven mechanical rakes. Screenings are carried by belt-conveyor to disintegrators, where they are macerated and returned to the sewage above the screens. A venturi flume at the outlet of each grit chamber records the flow and also maintains in each channel a velocity of 1 ft. per second. The grit is removed by a suction dredge, washed, and pumped to settling ponds. Each grit chamber is 90 ft. long.

All sewage up to 3 times the dry-weather flow enters 8 primary sedimentation tanks, circular with 95 ft. diameter and 12 ft. average depth, with central inlet and peripheral weir and electrically operated scrapers for removing sludge to a central well. The effluent flows through 4 rectangular secondary sedimentation tanks, each 200 ft. by 150 ft. by 12 ft. deep, from which the sludge is removed to hoppers by an electrically operated Mieder-type scraper, which has a span of 75 ft., one end travelling on a central longitudinal wall, and which removes scum on its return. One scraper serves all the tanks.

The aeration tanks are built in two batteries of six tanks each; each unit consisting of four channels 400 ft. by 15 ft. by 12 ft. deep; with a total capacity of 20 mg. One battery is arranged to operate on the spiral flow principle, with two rows of 8" diffusers on one side of each channel; the other battery on the longitudinal ridge and furrow principle, with three rows of 6" diffusers spaced 5 ft. centers. Each battery can be changed to the other type easily if one type should show marked superiority. Return activated sludge is mixed with the entering sewage in an aeration channel. The mixed liquor flows through the four channels of each tank in series, thus travelling 1600 ft., and then to the



Mogden sewage treatment works: General plan, and diagram showing the process employed.

final separating tanks, of which there are 40, each 60 ft. diameter with central inlet and peripheral weir; thence flowing directly to the Thames river. The sludge is scraped to a central well and discharged by hydrostatic head to a pumping station, where an amount equalling 15% to 50% of the sewage flow is returned, (together with a similar amount of final effluent, if desired), and the surplus pumped to the inlet to the primary sedimentation tanks or to the digestion tanks, whichever is desired. Any number of the aeration units up to 4 can be used as sludge reconditioning tanks.

Wet-weather flow in excess of three times the dry-weather is diverted to storm water tanks, eight in number, each 230 ft. by 150 ft. by 12 ft. deep, similar in most respects to the secondary sedimentation tanks, including the Mieder-type sludge remover.

The above plant is now in operation, and already an addition of 3 aeration units and 12 final tanks, required by the large increase in population, is under construction.

Sludge from the primary, secondary and storm water sedimentation tanks is pumped to two thickening tanks, each 35 ft. diameter and 20 ft. side water depth, and thence to circular digestion tanks, twelve in number, 70 ft. diameter with a total capacity of 10 mg.; four of which have a side water depth of 32 ft. and center depth of 34 ft., equipped with a stirring mechanism and fixed roofs, while the other eight have a side water depth of 32 ft. and center depth of 51 ft. and are provided with gas holders of the spiral carriage type.

About 800,000 cu. ft. of methane gas per day is produced by these tanks, with a calorific value of about 650 B.t.u., which is used for the generation of power in the power and compressor house, the present output having an electrical equivalent of about 15,000,000 units per annum; which will effect a saving of at least £ 20,000 in annual charges after making allowance for loan charges. The waste heat from the engines is used to maintain the digestion tank temperature at about 80°. The sludge, after having been in the digestion tank for about a month, is pumped seven miles to the Perry Oaks works for final digestion in ten circular tanks 100 ft. in diameter with water depth of 30 ft. at the sides and 34 ft. at the center. From these the sludge is pumped onto 50 acres of drying beds, divided into 62 plots. These are of sand and graded gravel 18" deep, the coarsest gravel being of 2" gauge, with a comprehensive system of underdrainage discharging into a sewer which returns it to the Mogden works. A wall of puddle clay surrounds this entire area, carried down to a clay stratum, to prevent contamination of subsoil water.

The power plant includes eleven Diesel oil engines totaling 6750 hp, ten of which are convertible to running on methane gas. Six of these drive turbo-blowers each capable of compressing 12,500 cu. ft. of free air per minute to 7 lb. pressure; and four coupled to electric generators which produce 460 volt D.C. circuit used for operating pumps, work shops, tank and other machinery and lighting. The eleventh engine is for emergencies. The pumps have a capacity of 138,000 gpm, requiring 3,960 hp.

All the sewage reaching the Mogden works is measured by electrically operated, indicating, recording and integrating, venturi and flume meters, six 15" meters measuring the dry-weather flow and six 30" the storm water flow. There are also meters for the sludge, return sludge, surplus sludge, mixed liquor, compressed air, gas and oil. Also 52 venturi flumes with semicircular bottoms ranging from 24" to 66" width are placed in the branch sewers of the outlying districts. Each

sludge concentration tank is supplied with a level indicator, operated by compressed air. There are numerous other meters, distance thermometers and other apparatus for giving information concerning practically every feature of the operation of the plant.

The above description is condensed from one given in "The Surveyor."

Laying Water Mains in Four Feet of Frost

By LEE HARVEY

Supt. Water Works Dept., Conneaut, O.

LAYING two thousand feet of twelve inch cast iron water main in four feet of frost as a W.P.A. project was an interesting and worth while job carried out last winter by the Conneaut, Ohio, Water Department. This pipe line was planned to not only supply an outlying colony of one hundred twenty-five summer homes on Lake Erie but also to be connected to the main distribution system to furnish better fire protection and service to the Nickel Plate Railroad and factory districts.

There were sixty-two men of all vocations assigned to this project—engineers, conductors, switchmen, newspaper reporters and bank clerks, besides many others which space prevents listing.

The trenching was accomplished with shovels, picks, sledge hammers and chisel bars. To prevent accidents, the chisel bars were held by an iron handle made similar to an eye bolt. The trench was two and one-half feet wide, six and one-half feet deep. The soil was of a sandy nature but when frozen was like concrete. It was not necessary to brace the trench, as at intervals there were left spaces of earth six or eight feet in length which were tunneled underneath, allowing the pipe to be shoved under them. This not only eliminated the bracing but it also saved excavating a large amount of frozen earth. The average day's work was 72 feet of pipe.

The thermometer was hovering around the zero mark and at times was sixteen degrees below, which added to the discomfort of the men.

There are many complaints by the public about the laxity of the W.P.A. workers but I wish to state that the men who were assigned to me did their work well, considering that the majority were amateurs at this class of work, and many were not properly clothed and no doubt were undernourished.



WPA workers posing. (Contrary to popular impression, this is not their customary attitude.)

Check List for Winter Danger Spots

- | | | |
|-----------------------|--|-----------------------|
| 1. Sidewalks | 6. Straight Highways | 11. Bus Stops |
| 2. Driveways | 7. Bridges and Viaducts | 12. Stop Streets |
| 3. Grade Crossings | 8. Dangerous Intersections | 13. Traffic Lights |
| 4. Safety Isles | 9. Cross Walks | 14. School Bus Routes |
| 5. Hilly Streets | 10. Curves | 15. Loading Platforms |
| 16. Trolley Car Steps | 17. Steps (Homes and Public Buildings) | |

Safeguarding Winter Danger Spots

A LARGE portion of winter accidents result from skidding of wheeled traffic on icy highways, but there are many other danger spots. We believe that city officials charged with public safety and with the duty of maintaining streets in the safest and best condition will find the check list given above of value in planning a campaign to reduce, so far as is possible, the winter dangers to traffic and to pedestrians.

Sand or cinders are the commonly used materials for preventing skidding. The addition of 50 to 75 pounds of calcium chloride per cubic yard of material will prevent stock piles from freezing; an additional treatment in about the same amount should be made just before applying the material to the danger spot. Such material may be stock-piled in the late fall at danger points, or placed in boxes. This latter has the advantage that there is material always readily available and easily reached. Piles may be spread and material lost from traffic or other causes, or washed away by heavy rains. From these or other reasons, there is often considerable wastage.

It is best to apply the material on highways, on long curves and on large bridges or viaducts by means of mechanical spreaders. These do a better and a more economical job than is possible with hand work. Treatment should be at the rate of about $1\frac{1}{2}$ to 2 pounds of the prepared sand or cinder per square yard of surface. The same amounts may be used for hills, stop streets, traffic lights, grade crossings and dangerous intersections of all sorts. In some of these places, as on long hills, the mechanical spreader can be used, but for most of them hand spreading will be more economical because of the relatively small area usually involved. For stop streets, grade crossings and intersections generally, the grit can be spread from a light truck by one or two men with shovels. This avoids placing boxes or stock piles at busy intersections.

Bus stops may need some attention so that the buses and other vehicles, as well, can stop without skidding. The treated sand or cinder is also most effective on these spots. Routes of school buses should be watched especially and dangerous stopping places cindered or sanded.

Sidewalks and crosswalks should be kept free of ice and snow, so that the pedestrian will have good footing. Prompt removal of the snow is surest and

best, but ice nevertheless sometimes forms. Treatment of the ice with calcium chloride or other similar chemical quickly melts or breaks up the ice which can then be shoveled off the sidewalk or crosswalk. Next to removal of the ice, the application of properly treated sand or cinder is most effective.

Many cities have safety isles for street cars. These should be kept in a safe condition, which is not the case when they are covered with snow or ice. A fall may result in a damage suit. The same general treatment as mentioned in the preceding paragraph for sidewalks and crosswalks will be effective.

The steps of public buildings offer many opportunities for accident. Some cities place a wooden walkway over such steps, but even these become icy and slippery. Calcium chloride can be sprinkled directly on the ice or snow coating, permitting its quick removal. The steps of private homes may be treated in the same manner, though this is a matter for the individual and not the concern of the community, except generally. Likewise the convenience of open and easily used driveways is largely the concern of the individual; removal of the snow, melting of the ice with the aid of a chemical, or the use of treated grit are effective, the method to be used depending largely upon local conditions.

Trolley car steps, loading platforms, etc., are other sources of danger if they are covered with snow or ice. Methods already outlined will be effective in any necessary treatment of these and other similar potential danger points.

Sewer inlets, catch basins and fire hydrants should be kept open and in working conditions during the winter. A calcium chloride or salt solution poured directly into the manholes or catch basins will melt the ice or prevent freezing if ice has not already formed.

Traffic Line Painting on Rhode Island Highways

Traffic line painting in Rhode Island has been somewhat altered, the system of broken line painting having been adopted. This method of painting a four inch strip for seven feet and then allowing an interval of nine feet before resuming the painting, has been found to be economical and at the same time to furnish the guidance necessary.



Laying a cut back properly gives an increased sight distance. Rounding of the high knob has not yet been completed.



Who says that a 1:1 slope won't erode? The trouble shown could have been greatly reduced by backsloping and rounding.

Roadside Development for Counties

By F. M. GUIREY

Landscape Engineer, Arizona State Highway Department

ON a recent trip through twelve of our Western National Parks, I had a chance to observe firsthand a great deal of the work that is being done under the direction of the National Park Service. Most of it was very good—simple and well studied, with a thoroughly understood use of native materials, which should constitute to a great degree the backbone of this type of work. Although the surface has been barely scratched, and many of the trees recently planted are still too small to show up to anything like their ultimate size, the work performed stands out so definitely that even the most casual tourist traveling through the various states can not help but see the foundation that has been laid in the program for this latest and logical step in the development of our highway systems, both national and State.

The question arises: What can the average county, say one spending between \$150,000 and \$300,000 annually, do in this field? By that, I mean how can an allocation of a part of these funds be spent to bring about a real dollar-for-dollar value to the people whose money is being used for county roads. Here is a suggested answer: Roadside development is no high-powered hocus-pocus to be dragged from under a blanket and waved in the face of an awed public. It is an honest solution to a problem involving the various factors of safety, simplification of maintenance, comfort for the traveling public, and eye appeal—for a great percentage of our highway users are pleasure bent.

There are a number of agencies that will gladly furnish information regarding planting material and installation procedure. The U. S. Department of Agriculture has prepared a number of valuable booklets that may be purchased for a nominal sum. Universities will offer worthwhile advice, and many good tips may be gleaned from an experienced nurseryman with regard to the handling of young trees and shrubs. Problems involving esthetics and design should be carefully studied with the aid of a competent landscape engineer. Most of the State highway departments now carry a Landscape Division, from which helpful services may be obtained, as well as actual aid in the preparation of a program for this work.

Before going into the actual allocation of funds, a start can be made involving little or no additional expense, and when the plan has developed toward the final stages, the matter of finances may be given definite consideration and steps be taken toward getting a staff that will function efficiently within the limits of a small budget. Naturally, no one solution will apply to every county in the United States; local conditions varying between the widest extremes call for the careful study and analysis of individual problems.

Landscape work may be roughly divided into two major types: First, municipal development; second, highway or open road work.

Open Road Landscaping

The greater portion of county landscape work will be done on the open road. In a broad sense, landscape work on highways should be done with a view of returning to a natural condition the land adjacent to the road, where much of the natural beauty has been destroyed.

How does your right of way look? Is it devoid of vegetation? Does your road boast a string of death-breeding borrow pits? Have your cuts been hacked through the soil and left to erode? Are your fill slopes of such a steepness that the erring motorist who inadvertently runs over them has an excellent chance of waking up with a harp in his hands? Have your culverts, boxes and dips been so designed that they have caused concentration of runoff with resultant scouring and gouging? If you can truthfully say "no" to all of these questions, you deserve a medal, and need not read farther in this installment—but think carefully before answering, and above all, be honest!

Assuming that you're still with us, let's look at the first and see what can be done in the way of conserving plant material now on the job. You may find that you have some fine old trees that, through neglect, have dead wood in them, broken branches, unsightly form through improper trimming for various kinds of clearance, or other imperfections. You may also find that you have some nice native shrubs that are badly choked by dead brush and weeds. Shrubs make a very effective screen for unsightly structures such as railroad grades,

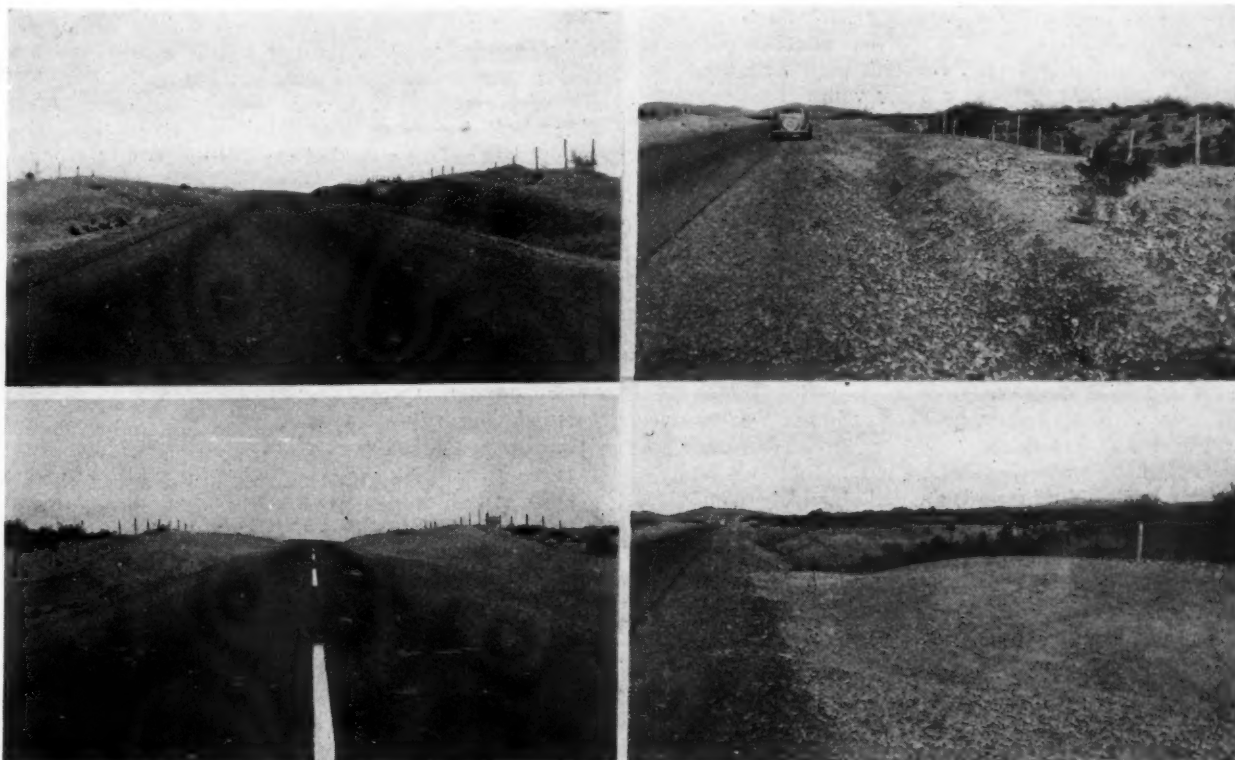
sheds, billboards, etc., and are well worth saving. Badly crowded young trees may also be aided in making a normal, healthy growth by proper thinning. Take stock of what you possess, save everything that is of value, and take steps to bring about a realization of its greatest worth. Trees on the outside of a curve make an effective guide to show up the alignment of the roadway. When on the inside, they should be kept sufficiently thinned and trimmed to afford adequate sight distance. The same thing holds true for intersections. In fact, it is recommended generally to keep all sight obstructions back at least 100 feet from intersection center lines. By the removal of weeds, fire hazards are reduced—and remember, one living tree is worth many, many dead snags, for it costs real money to establish new growth, and takes time for it to mature. Furthermore, growth which is already established has passed through the development stage and presents an immediate value. It is difficult to place too much stress on this one point. *Make the most of what you already have. Do not destroy anything until you are absolutely sure it is worthless. If necessary, consult a trained landscape engineer.* In the past, millions of dollars worth of trees have been lost through a ruthless clearing of right of way. Actual methods and technique in trimming procedure will be covered in a following installment.

Borrow pits—If you have any of these, there are two things that you may do to remedy them. One: fill them up. Two: backslope and blend them into the surrounding ground so that they present a smooth appearance. You may not be able to get them all worked over at once, but if, every time you work on your shoulders, you hit the pits a swipe with the blade, keeping in mind the ultimate aim of flat slopes (which have less tendency to erode, and present a safer surface over which to drive when necessary), it will not be long before your efforts begin to bear fruit. The strong tendency on the

part of the average blademane to gouge deeper and deeper into a pit should be curbed. It is no more expensive in the long run to move his shoulder muck across from the far side of the pit than to gouge it out of the bank. And once the pits have been properly worked out, leave them alone. Usually grass will re-seed of its own accord. In the areas where re-seeding is difficult, valuable assistance may be obtained from the U. S. Soil Conservation Service. Other agencies such as State Agricultural Colleges, U. S. Forest Service and Carnegie Institute have carried on considerable research in the search for soil-holding grasses and shrubs. It is usually possible to obtain seed from one of these agencies, along with instructions for planting.

Cuts—On the same general line comes the subject of cuts, both through and side hill. The standard in use by the Arizona State Highway Department is typical of the entire country. The letter of the procedure described here need not be followed, but the general effect to be achieved is getting backslopes that blend easily and harmoniously into the surrounding country. When properly done, erosion is reduced—particularly because grass seems to find it impossible to come down over a slope which has a sharp break, with the result that the bare soil below the edge of the cut keeps washing away and undercutting, with eventual serious erosion. When the slopes are smoothly blended, reseeding by natural means is greatly aided and in many cases is complete within one or two seasons. Where heavy runoff over a slope is encountered, a few contour ditches will help greatly in preventing scour prior to the establishment of grass. Crown ditches with a series of well-placed checks may also be used to advantage. In a recent U. S. D. A. pamphlet by Charles J. Kraebel, "Erosion Control on Mountain Roads," some excellent material may be found.

For performing such work, on average cuts (say up



Before above and after below. Note how much better the rounded slopes below fit the surrounding country. Observe shallow ditch in lower picture, which affords a margin of safety for drivers.

Before above and after below. Ditch in upper picture is larger than drainage warrants. How would you like to drop a wheel in it? Below, you could even drive out on the knoll.

to six feet), a cat-blade combination will do wonders. A motor patrol can be used on small cuts and in borrow pits successfully. In fact, scrapers, four-ups, bull-dozers, or anything else you can lay your hands on will serve to rough out the work. If no power equipment is available, men with picks and shovels can handle work of this kind readily—a number are now under way as W. P. A. projects. Disposal of material is not often a problem, for usually, on through cuts, material for shoulder maintenance has been taken from side ditches, making them far deeper and wider than drainage will ever require, and made them not only unsightly but dangerous. Furthermore, they constitute a psychological hazard, in that they tend to make the road appear narrower than it actually is. Usually by the time these ditches are filled, your backsloping is complete, eliminating in most cases the necessity of hauling earth that has been removed in the process of construction.

The reaction of drivers to these new-type slopes is interesting, and, in many instances, amusing. I have seen cases where they ran up and down slopes for the mere fun of it, showing that slopes of this type offer a far greater margin of safety than do those of the old standard 1:1. Flatter slopes also mean increased sight distance—another safety factor not to be overlooked.

Notes on Grading

One more thing about grading. Often areas are found where a little additional work, maybe only one or two cuts with a blade, would provide an easily accessible roadside park or parking area. This is particularly true in mountainous districts, where the daylighting of through cuts has left wide places alongside the road. Such areas provide a real service to the traveling public, in that they give a driver who is having car trouble a chance to leave the road to make minor repairs in safety. In districts where truck travel is heavy, these areas will help to relieve congestion, for the average truck seems to stall much more readily than the average touring car. Sometimes a pleasant grove of trees will be found where, if water is available, an excellent camp ground may be developed. Lookout points advantageously located on summits or other vantage points add a note of real interest for the traveling public. Development of areas of these types will depend greatly upon the location of your highways and the types of motorists using them.

The flattening of fill slopes is well worthy of consideration as a safety measure. This work is more expensive generally than backsloping, for, in many instances, the material used must be imported. There are, however, possibilities of working material across a borrow pit when backsloping it, to provide a more gentle slope down from the roadway.

The placing of sod on backslopes is more expensive than seeding, and not necessary unless the slope is so steep that seed will be washed out before it can take root. In cases of this kind, the sod should be carefully selected from a clayey soil, one that will not readily break up or wash, and be thoroughly pegged in place. In his book, "Roadside Development," J. M. Bennet gives a good description of the procedure to be followed in this work. In a general sense, slopes of 2:1 or flatter can be successfully seeded, and, in some instances, a slope as steep as 1:1 will hold.

One final tip with regard to finishing. A heavy brush drag serves admirably for final dressing. It is much cheaper than hand work, and overcomes the tendency of power equipment to tear up small rock, partially exposed snags, etc. After all, a mirror-like finish is not vitally necessary, for the first rain or wind storm de-

stroys it. Rather a well-blended surface containing a few natural bumps than a marred sandpaper job with the shine knocked off.

Drainage structures are often too small because the expense of making them sufficiently large to allow flood waters to pass through without building up additional head was considered prohibitive. We may find an occasional pipe that has a steep enough grade to turn it into a hydraulic nozzle. Both of these conditions can bring about serious scour, which may eventually endanger the roadway proper. The remedy for this is not usually simple, but small concentration areas can often be helped by the use of check dams with rock baskets. Such dams, when carefully placed, slow down the rate of run-off to a point where it will no longer scour, thus saving far more than the original cost in the land saved from erosion, to say nothing of maintenance costs. There are also types of growth, such as black locust, which are excellent soil holders. Another method of protecting a soft bank is by the placement of a good dry wall made up of old broken pavement slabs, and then planting a hardy type of grass, which has an extensive root system. Such walls are not difficult to lay up, though care must be taken to prevent undercutting. They present a far better appearance when planted than would a badly washed bank.

This should be almost enough for this time. If you are still interested, another article is soon to follow, covering the planting of trees and shrubs, and a general discourse on highway planting layouts.

Towns Find Local Gasoline Taxes Unprofitable

Missouri and Florida, among the states in which city gasoline taxes flourish, are removing these local gasoline taxes. Three towns in Missouri have recently repealed their city gas taxes and three others have defeated attempts to impose such taxes for the first time. In Florida four towns have terminated their local levies in the past few months.

The most recent local gasoline tax to be ended is that of Humansville, Mo. Following persistent efforts of local oil dealers to have the tax eliminated, the city council has at last repealed the ordinance under which 1c a gallon was collected on all motor fuel sold within the limits of the town. Other Missouri cities which have reduced their gasoline taxes include Excelsior Springs and Lupus, both of which formerly had 1c local levies.

In Slater, Missouri, a proposal made to the city council to finance a municipal park and swimming pool through a city gasoline tax was defeated by that body after a public hearing on the measure and attempts to impose municipal gas taxes in two other Missouri towns, Sullivan and Ellington, were also defeated when the idea failed to meet with popular approval.

Deland, Palatka, Cottondale, and Gainesville are among the most recent Florida cities to terminate their local taxes on motor fuel. All of these towns suffered loss of business following imposition of their local levies.

Filling stations sprang up outside the town limits and displayed large signs warning motorists not to purchase gasoline in the town where the price was higher because of the local tax. Many of the filling stations within the city limits of these municipalities went out of business. Hotel owners reported that their business was falling off. As a result of these developments, the expected revenue to these municipalities failed to materialize and one after another the taxes were repealed.

Repairing and Lining an Old Sewer in Indianapolis

By M. G. JOHNSON

Senior Assistant Engineer, Board of Public Works and Sanitation

ABOUT thirty years ago Indianapolis, Ind., built a sewer in Harding Street from Washington Street south to White River, a distance of about three miles, which varied in size from 3.5 ft. diameter at the upper end to 12 ft. 4 in. wide by 8 ft. high, horse-shoe shape, throughout the lower half. Later, when the city's sewage treatment plant was built, this sewer was converted into one of the largest interceptors bringing sewage to it.

The sewer was constructed of monolithic concrete and was not reinforced. The concrete was of only a fair quality, as was most concrete poured at that time, and the aggregates were taken from the excavation and not graded. The result is that the sewage gases have attacked the cement to such an extent that the entire surface has become soft and very porous. Nails may be driven in almost any place without difficulty.

A few years ago a section of this sewer gave way and caved in. A temporary repair was made to this section, but due to the lack of funds a new sewer or further strengthening of the old sewer was delayed to a later date.

When the Works Progress Administration was set up about August 1st, 1935, repairing this sewer seemed to measure up to WPA requirements in that it was "public work," also a "utility," and would give employment to a large number of men and would relieve the taxpayer of the burdensome expense of building a new sewer, which otherwise would ultimately be necessary. Accordingly an application was filed for a complete program of cleaning, repairs and a "gunite" lining, and was approved.

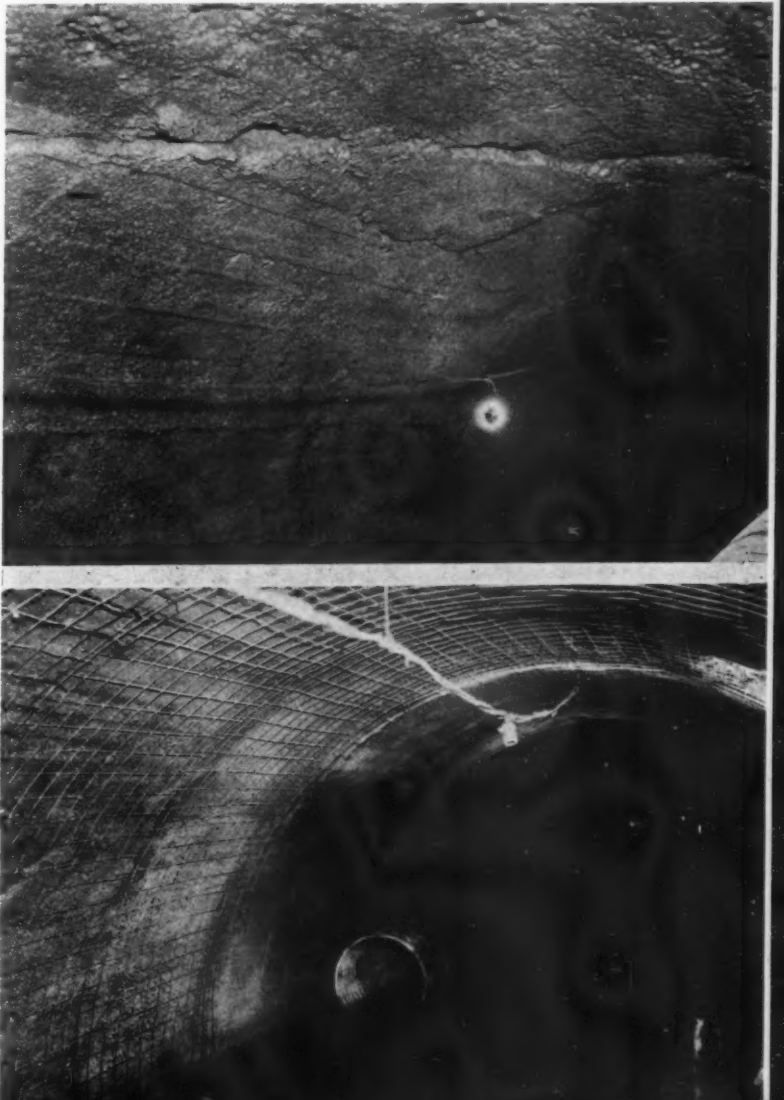
Some preliminary work was started in the fall of 1935. The first cement gun unit was put in service about the middle of last December, a second unit being added the first of April, 1936. A 2½" gunite lining is being placed on the walls and floor, reinforced with an electrically welded wire mesh of No. 8 wires, spaced 4" on center in each direction and attached to the surface by means of "American" expansion bolts. In some sections, the condition of the sewer was so dangerous it was necessary to place as much as 5" of gunite and double the reinforcement.

The work is being carried on with the sewer in service as a combination storm and sanitary sewer. The workers use hip boots while working on the side walls. When the floor of a section is being repaired, a watertight bulkhead is placed at each end and the sewage flumed through 24" corrugated pipe for a distance of 500 feet or more at a time. The normal depth of flow in the 12' 4" section is from 12 to 18 inches. When repairs to the floor are in progress, a portion of the sewage is diverted into other sewers and some direct to the river, which can only be done in cool weather. This makes it possible to flume the remainder through the corrugated pipe, the bulkhead being made of sufficient height to create a head and thus increase the discharge of the pipe. In times of heavy rains it is necessary to suspend operations, but the run-off is very rapid, in

spite of the fact that the sewer has a very slight fall in its entire length, being zero grade in many places.

The WPA is providing all the labor and equipment rental and a part of the material. The equipment consists of two complete cement gun units, inclusive of all accessories. At the present time there are two electric-driven air compressors having a capacity of more than 300 cubic feet of air each, with manifold piping to one large air receiver. From this a 2" air service line is run about 1000 feet and fitted so a cement gun can be cut in at various points, from each of which the material is discharged through hose of lengths up to 600 feet, so that a radius of about 1500 feet is reached from each compressor set-up, which occurs about every 3,000 feet. Each outfit includes sand dryers, pumps, pipe, shelter for the equipment, air receivers and hose—everything to make a complete "gunite" construction outfit; and a crew of two experienced men is furnished with each, as well as fuel, moving expense, repairs, replacement parts, etc.

View of old sewer before repairing and during the operation, showing reinforcement and pipe for carrying flow during repair work.



Lights are provided by use of a 750-watt Delco unit; although power lines run the full length of the project, higher voltage would be dangerous where the men are working in water. The men are limited to 130 hours time per month but the project is so managed as to average 150 hours per month by relaying shifts.

The total surface area of the sewer is 419,872 square feet. The total completed to September 1st was about 36 per cent. The estimated amount of cement to be used is 10,000 barrels. More than 400,000 feet of mesh will be used and 6,000 tons of sand. An average of 75 men are employed, under the direction of one superintend-

ent, one timekeeper and four key men. Ira Miller (an experienced construction superintendent) has direct charge of the project. The total cost to date is about 45c per square foot, which includes all cleaning, sewage diversion, gunite, and restoration of sewer and pavement where it is necessary to cut through for ventilation and entrance.

The sewer is under the authority of the Board of Public Works and Sanitation. H. B. Steeg is city engineer; C. K. Calvert is chief sanitary engineer and M. G. Johnson is senior assistant engineer, under whose direction the repairs are now carried on.

Dust Storms and Mid-West Highways

By BEN L. ALLEN

County Engineer, Finney Co., Kansas

ENGINEERING has been defined as "the science of controlling the forces and utilizing the materials of nature for the benefit of man." In a few of the western states during the last year and a half nature has refused to be controlled.

This is certainly true in relation to dust control, which has been a major problem since improved roads have become so necessary to the comfort and convenience of so large a per cent of the population of our country. A decade ago a graded, drained road with a good gravel surface was considered the ultimate for most roads, but as high-speed automobiles began to grind the gravel to powder some method of dust control was sought, and the desired end was accomplished with the use of calcium chloride, penetrating oils and oil mats.

When, however, whole townships and even counties become dust laden and three or more inches of surface soil refuses to stay put, man with all his resourcefulness begins to realize how futile was his ability to control the forces of nature to his benefit. This condition confronted western county and state engineers for a period

of more than eighteen months, and many of them now are seeking means of repairing road systems which have in many places practically disappeared.

Three-foot ditches on elevated roads have been completely filled for miles; gravel in windrows on the shoulder gathered on the lee side a drift of dust equal in height and twice the volume of the gravel; culverts and concrete boxes filled completely, and where not indicated by posts, the former became absolutely lost; weeds gathered in fences and dust drifts piled in and across the roads just as snow does, and with no hope of warm weather removing them.

And then the rains came—not gentle spring rains, which are not usual in the plains region, but one, two, or more inches in a few hours. The dust, as fine as cement and carrying much vegetable matter, filled our ditches, culverts, fields and pastures, and was almost impervious to water. There could be but one result, and that was a run-off of one to two hundred per cent of normal, and the erosion by water completed the job. Culverts and boxes plugged, and where roads were not elevated, weed growth on the back ditch slope had filled with dust and converted the road into a canal. No damage to bridges, but approach fills which had stood for ten years were washed out. It will require three years of normal rainfall seasons to get our roads back to the condition they were in in the spring of 1935.

I write as a county engineer, think and write of county roads; but what is true of county roads applies to state systems in a much lesser degree. Are we discouraged? No—only as we visualize the utter lack of production of our rich farm lands for the past three years, and the financial plight of our farm population. Will we come back? Most assuredly, for the farmer is practicing wind erosion control as religiously as the eastern land owner practices water erosion control, and with consistent control methods our prairie farms will cease to blow and drift and our roads will not again suffer from soil drifting.

Diversion of Funds a Maine Issue

At its Statewide election on September 14th, Maine voters adopted a referendum bill strictly prohibiting diversion of highway funds to non-highway purposes. Maine thus joined Colorado, Kansas, Minnesota and Missouri in taking legal measures to protect highway funds from diversion.



An approaching dust storm and its result.

The Editor's Page

Training Sewage Works Operators

With the continually increasing number of modern sewage treatment plants, but even more because of the need for the most efficient operation of all plants, old as well as new, there is a real demand for facilities for the better training of operators. A number of the State universities are doing something in this field, but careful planning for and presentation of instruction beyond the usual "short course" are not found in many of them. Not only is the time allotted too short for anything beyond elementary principles, but in many cases too much of this time is taken up with papers and discussions describing how plants have been built rather than how to operate them.

A recent careful survey of published material showed extremely little of it actually to relate to operation, as the operator views it. Considerable literature on this subject related only to the end results of operation, that is to reports on costs (which are important) and results of treatment; and only a very scant proportion of it gave any data of assistance in teaching the operator details of "how to do it."

One state college, however, has prepared a 5-year schedule for the training of sewage and waterworks operators, covering in detail the various duties, and has arranged this so that attendance at short schools, correspondence work and lectures presented at planned local meetings all fit into the general program of instruction.

Considering the fact that few sewage works operators are so highly paid as to be able to finance much of a college course, and that they even find difficulty in getting away long enough to take the customary two-weeks course, the arrangement mentioned above appears to offer the most realistic basis for training.

After Santa Claus, What?

Those donations through PWA, WPA and other alphabetical agencies are going to stop some time—perhaps before many months. And then what? Much has been said about the demoralizing effect of relief on many of the unemployed; has it had such effect on our cities and counties? Will they "set up a howl" when they are told that in future they will have to pay for all of their improvements out of local rather than federal taxes? We hope that their self-respect will prevent this, and we believe that in the majority of cases it will.

But we also hope that they have not acquired a Scotch complex on spending their own money for public works; nor, on the other hand, a habit of extravagant spending without trying to get the value for every dollar. The wise municipalities will avoid both. For both the physical and financial good of their communities they should continue to bring and keep their public works at a high standard and so give work to their citizens, but should return to old-style economy in doing so. And this should be considered in preparing the 1937 budget and the means provided for doing it.

Another matter also should be provided for in the budget—the maintenance of the new public works acquired so abundantly during the past three years. A park is a great asset if kept up in good appearance, but

if allowed to run to weeds it becomes a disgrace. The new sewage treatment plant is something to be proud of—but not if the appropriation for operation is inadequate. New roads are enthusiastically applauded by the 99% of the population who own autos; but neglect their upkeep and let potholes develop and see what that 99% says!

To keep up what we have recently acquired and to add new will of course mean spending, and that is what we must make up our minds to do. And we can do it. Not for years have the finances of our cities and counties been in such good shape, and business prospects are brightening weekly.

Industrial Water Supplies

We do not often comment editorially on current articles, but in this issue is an account of one that deserves special comment. The Birmingham Industrial Water Supply is an outstanding example of long-time vision, courageous planning and will to overcome obstacles.

Too little consideration has been given to the matter of water supply for industries, so far as many of our cities are concerned, but in the future this will no doubt be changed. Cheap water and plenty of it is a need of certain types of industries. High-priced water, relatively speaking, that has been highly purified is not always needed. In many localities individual sources of supply have been developed by the various industries. The total cost of all such developments may be more than sufficient to provide an industrial supply, while their operating costs may be considerably more than the cost of purchasing such water, since most of the individual industrial supplies must be pumped.

Perhaps the men who planned and carried through the job described on another page of this issue have shown the way to a new waterworks construction field.

More Highway Accidents Occur After Dark

The records of four states where an accurate count of day and night traffic accidents has been kept show that night accidents have increased steadily for almost a decade, while the number of daylight accidents has decreased. These states are New York, California, Massachusetts and Connecticut.

We do not know what the increase in night driving has been, but statistics do show that proper lighting of highways has been a potent and effective means of reducing such accidents. Lighting on Bay Shore Boulevard, San Francisco, reduced night accidents 40%; in Schenectady County, N. Y., accidents at night decreased 36% on the Troy-Schenectady highway after adequate highway lighting was installed, meanwhile daytime accidents increased 9%. Night fatalities and accidents increased 2½ times when lighting was discontinued as an economy measure on the Mt. Vernon highway near Washington; in Westchester County, N. Y., night accidents rose 37% from the same cause.

Modern lighting equipment is one means of increasing highway safety. It should be utilized to the utmost.



Laying 60-inch steel pipe with Dresser couplings and view through pipe interior.

THE Birmingham (Alabama) Industrial District is located in an area which is not adjacent to a major river and where the creeks, having relatively small drainage areas, have very small flows during the periods of light rainfall. Underground sources supply a substantial quantity of water but, due to the limestone and dolomite formation, these sources of supply are not dependable, since water from them may materially decrease in quantity or entirely disappear without warning.

The normal consumption of water from the above-mentioned surface and underground sources of supply is approximately 120 million gallons per day. Most supplies have been developed to their limit and therefore very little additional primary water is available in the immediate district. The Birmingham Water Works Company has an excellent supply of high-quality water available for all domestic and municipal uses and is supplying approximately 3 per cent of the water used for industrial purposes. Due to the high quality of this water and the expensive distribution system necessary to serve its major purposes, the cost of this water necessitates a charge for industrial purposes which, where the consumption is extremely large, is greater than most industries can afford to pay, inasmuch as their requirements can be met by a water of lower quality.

In order to provide industries with more and better water than many of them can obtain from their present supplies and to provide a supply sufficient to meet the demands of expansion of present industries and the requirements of new industries which might find this district a desirable location, it was decided to investigate the possibilities of providing a supply of water for industrial purposes adequate in quality and quantity for the present and with reasonable provisions for the future.

Following studies made by one of the major industries in the Birmingham District, the Birmingham In-

New Industrial

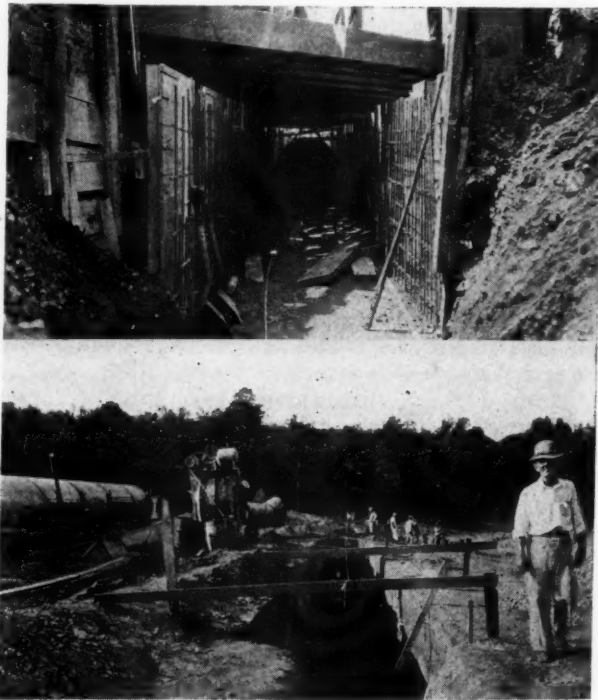
A separate system being built for industrial use at a cost of \$5,808,000

By A. CLINTON DECKER

Member of the Engineering Commission for Industrial Water Supply

dustrial Board (now the Industrial Division of the Birmingham Chamber of Commerce) and the City of Birmingham, it was decided by the last to file an application for a loan and grant with which to construct an industrial water supply system having a capacity of 60 million gallons per day. On December 15, 1933, an application was filed with the P. W. A. for the necessary loan and grant with which to construct such a system. After considerable negotiations and finally the securing of contracts from industries for the purchase of water if and when such supply became available, the application to the P. W. A. was revised so that the P. W. A. was requested for a loan of \$3,430,000, while the W. P. A. was requested for a grant of \$2,378,000 with which to construct the new water supply system.

The request for the loan from the P. W. A. stipulated that the funds secured from this source would be used for the purchase of all lands, easements and rights-of-way for the entire system; for all legal and administrative expense; for all engineering (including inspection); for the construction of the impounding dam;



Above—Constructing concrete box culvert to carry 42-inch steel pipe under railroad tracks. Below—Trench for 60-inch steel pipe to be placed under the dyke of the distribution reservoir.

Water Supply System at Birmingham, Ala.

for the construction of 85,600 feet of 60-inch supply main; and for the construction and equipping of the pumping station. The funds provided by the W. P. A. were to be used for the clearing of the reservoir site; stripping, test pits and borings (except diamond drill borings) at the dam site; the construction of the 2 miles of road from the main highway to the dam site; for the construction of the distribution reservoir; for the construction and equipping of the chemical control house; for the construction of approximately 147,000 feet of 60-inch, 54-inch, 48-inch, 42-inch, 24-inch and 16-inch supply and distribution mains; also the smaller service lines from the mains to the property lines of the consumers.

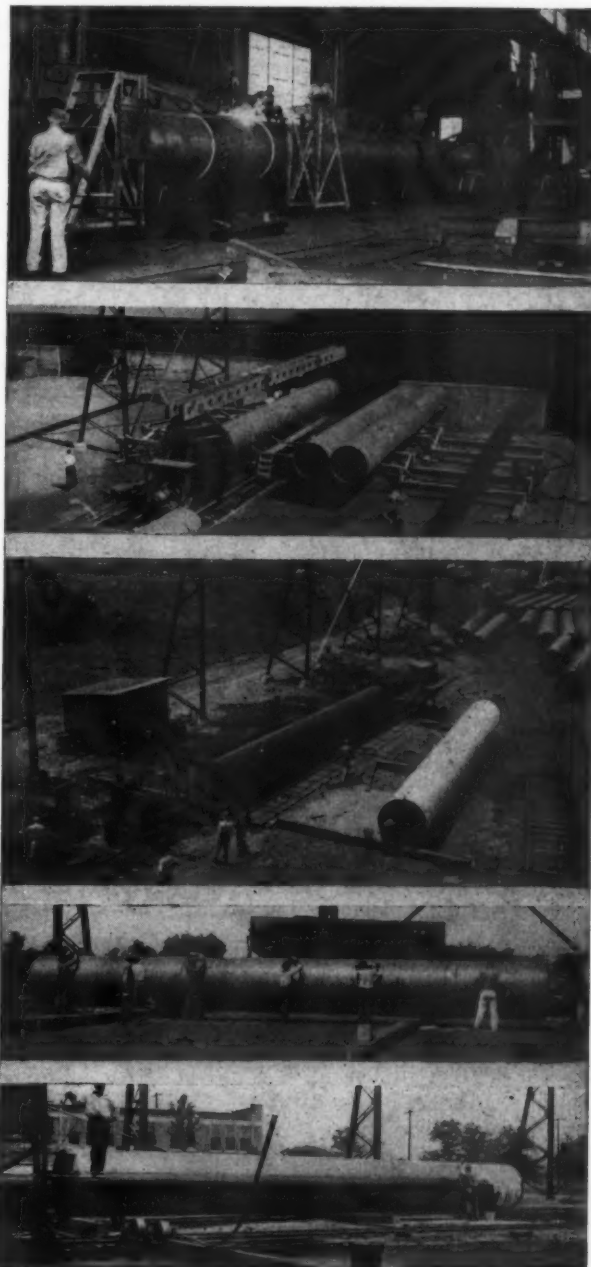
The preliminary studies and report for the application for funds had been prepared by an engineering commission consisting originally of A. J. Hawkins, city engineer, O. G. Thurlow and A. Clinton Decker. In November, 1933, when J. D. Webb succeeded A. J. Hawkins as city engineer, he also succeeded Mr. Hawkins as a member of the engineering commission. Advice of final approval of all funds for this project was received January 6, 1936, and at its regular meeting on January 7, 1936, the City Commission of Birmingham appointed the Engineering Commission for the Industrial Water supply consisting of J. D. Webb, chairman, O. G. Thurlow and A. Clinton Decker, with authority to handle all matters involved in the design and construction of this project, subject to the approval of the City Commission. The Engineering Commission selected A. C. Polk as executive engineer.

Mr. Polk decided on an organization of three major divisions. The distribution and supply lines and the distribution reservoir were placed under the direction of Harry Hendon as resident engineer and George Wall as chief inspector. For the Design Department H. J. Peterson was selected as chief designing engineer; and subsequently as the work progressed H. F. Peckworth was selected as resident engineer on the dam and impounding reservoir. H. A. Powell was selected as office engineer; A. H. Blair as geologist, and subsequently W. W. Garrett as electrolysis engineer; Silas H. Woodard was retained as consulting engineer for certain phases of the work and Sanborn and Bogert as consulting engineers on pipe lines and coatings; Dr. Charles P. Berkey of Columbia University was retained as consulting geologist to make geological examinations of the dam site and impounding reservoir basin, supplementing the work done by A. H. Blair. J. Ellis Brown was selected as land agent. The legal work is handled by W. J. Winn, city attorney, and J. H. Willis, assistant attorney. All financial matters are handled by C. E. Armstrong, city comptroller.

In order to put the greatest number of men to work as quickly as possible, the 24-inch and 16-inch cast iron pipe was requisitioned immediately by the W. P. A. The Louisville & Nashville Railroad was contacted and T. E. Brooks, vice president, immediately came to Birmingham and went over the entire proposed route for the pipe line with the Engineering Commission. He promptly offered to grant to the city rights-of-way for approximately 30 miles of pipe along the Louisville & Nashville right-of-way for \$1.00. Immediate construc-

tion on this right-of-way could therefore be undertaken. With this amount of right-of-way obtained so promptly and a very large part of the remainder being in dedicated streets, the matter of rights-of-way for pipe lines became a relatively minor problem and made it possible for the land agent to concentrate his major efforts on the securing of the lands necessary for the impounding and distribution reservoirs. The actual laying of pipe was begun by the W. P. A. in February, 1936, and the

- Top—Welding steel pipe in shop.
- 2—Testing pipe hydraulically.
- 3—Coating inside of pipe.
- 4—Cleaning outside of pipe before coating.
- Bottom—Applying whitewash to outside.



24-inch and 16-inch is now substantially complete, while approximately 13 miles of the 24 miles of 60-inch, 54-inch, 48-inch and 42-inch pipe has been laid. Substantial progress has been made on the distribution reservoir. The construction road to the dam is 95 per cent complete. The test pits and borings are complete and the stripping at the dam site is approximately 85 per cent complete.

The P. W. A. part of the 60-inch main is being laid by Christie Hutchinson & Burton Company of Birmingham, Alabama. This work was commenced in September, 1936, and during the first month approximately $2\frac{1}{2}$ miles of pipe was laid.

The cast iron pipe for mains 24-inch and smaller was made by the United States Pipe and Foundry Company in their Bessemer, Ala., shops, by DeLavaud process, cement-lined, and in the following quantities: 5,800 feet of 24-inch Class 100; 8,900 feet of 16-inch Class 100; and 13,500 feet of 24-inch Class 150.

All pipe 42-inches and greater in diameter is of steel, welded by the electric shielded arc method. All steel pipe is lined and coated with Bitumastic water works enamel furnished and applied by the Wailles Dove-Hermiston Corporation of New York. The lining is applied by the centrifugal process with the pipe rotating at a high rate of speed, and the coating is applied from a special travelling device while the pipe is rotating very slowly. All pipe is whitewashed on the outside in order to reduce the absorbed heat while exposed to the sun in hot weather before being placed in the ground. All pipes are made in standard lengths of 40-feet or 48-feet. The successful bidders for furnishing and delivering the steel pipe on both the W. P. A. and P. W. A. portions of the work were the Chicago Bridge and Iron Works Company and the Ingalls Iron Works, both of Birmingham, who submitted joint bids. All pipe is being jointed with Dresser couplings, thus increasing the amount of common labor used in the pipe line construction, skilled labor not being required to make the joints when this type of coupling is used.

All valves for the cast iron pipe, which were the 24-inch and smaller sizes were manufactured by the M. & H. Valve and Fittings Co., of Anniston, Ala. Valves, 30-inch and larger for the steel mains were furnished by the Ludlow Valve Manufacturing Co., Troy, N. Y.

The dam to be constructed will be 200 feet high with the spillway 184 feet above the bed of the river. This dam will be located near Inland, Alabama, approximately 30 miles north of the main business section of the city. The impounding reservoir to be formed will flood an area of approximately 1600 acres, will be approximately 7-miles in length and will have a capacity of 21 billion gallons. The dam will be of rockfill and earth construction, 1060 feet in length at its crest. The construction of the dam will involve the placing of 913,000 cu. yds. of rock, 621,000 cu. yds. of compacted clay and 26,000 cu. yds. of concrete for cut-off walls, spillway lining, etc. The preparation of the site involves more than 240,000 cu. yds. of common excavation and nearly 15,000 cu. yds. of rock excavation. To take care of water during the period of construction a diversion tunnel 20 feet in diameter and 1280 feet in length will be constructed through solid sandstone. This diversion tunnel will become the main spillway tunnel after the dam is completed. The contract for this dam has been awarded to the Walsh Construction Company of Davenport, Iowa, at a total bid price of \$1,685,231.

The spillway of the impounding dam is at an eleva-

tion of 784 U.S.G.S. datum. During periods when the reservoir is full or when the draw-down is less than 34-feet, it will be possible to maintain a head of 100-feet at substantially all points on the distribution system when water is being supplied at a rate up to 40-million gallons per day. When the draw-down is greater than 34-feet or when the rate is in excess of 40-million gallons per day water will be pumped through the main pumping station located at the dam. This station will be designed for an ultimate installation of five 20 mgd. pumps, with an initial installation of two such units. The system is designed for an ultimate average consumption of 60 million gallons per day.

Personnel and Progress

The W. P. A. work is being done under the direction of Ray Crow, State W. P. A. administrator, Montgomery, Ala., W. D. Twing, W. P. A. district supervisor, and Water Schoel, W. P. A. area engineer, the latter two of Birmingham, Alabama.

The P. W. A. has designated Major Wendell S. Merick as project engineer and H. A. Dunning as assistant project engineer. The Inspection Division of the P. W. A. have named W. G. McConnel as chief supervising engineer. The City Commission of the City of Birmingham consists of J. M. Jones, Jr., president, W. O. Downs and Lewey Robinson. This project comes under the Department of Public Works which is under the direction of Mr. Robinson.

The progress of the work to date may be briefly summarized as follows:

The engineering organization was perfected early in February 1936. All surveys are now completed. Specifications for all materials and construction work except the pumping station are completed and all contracts for which specifications have been prepared have been let.

W. P. A. pipe laying is sixty percent complete with all main line pipe having been delivered. Laying is now progressing at the rate of one mile per week. The test pits and borings are complete, the stripping eighty-five percent complete and the road ninety-five percent complete. The clearing of the reservoir is progressing relatively slowly due to inaccessibility and a shortage of labor. The distribution reservoir site has been cleared and the earth fill is now progressing at the rate of 500 cu. yds. per day, with plans being made to more than double this rate. The chemical control building is under construction and the equipment will be delivered in December 1936.

Delivery of 60-inch steel pipe on the P. W. A. part of the work began in August and is progressing at the rate of approximately one hundred 48-foot lengths per week. The contractor is laying pipe as rapidly as deliveries are made. The contract for the dam was let in September and the contractor has assembled considerable amount of equipment, has started work on stripping and on the diversion and spillway tunnel. The pumping station contract will be let in ample time for completion and equipping of this unit before water is available in the impounding reservoir.

In accordance with the agreement with W. P. A. at the time the grant was made, the engineering for the W. P. A. part of the work took precedence over the P. W. A. part, in order that the largest number of men possible could be put to work. Thus, to provide employment for the maximum number of men during the early part of the year the construction program was deliberately unbalanced and the pipe lines will therefore be completed considerably in advance of the completion of the dam.

Suggestions For Designing Swimming Pools

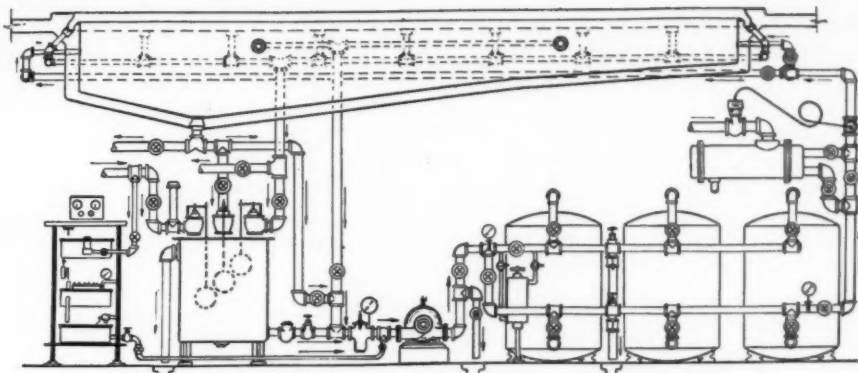


Diagram of a typical recirculating system: the Everson Filter Co.

WHATEVER the source or purity of the water used for a pool, it will need to be filtered and sterilized if the recirculation system is used, to remove lint, hair and other impurities washed from the bathing suits and bodies of the bathers, and to destroy any germs or infectious matter discharged from their persons. If the fill and draw or flowing through system is used, filtering and sterilization should be employed if the water is such that they would be necessary to make it safe for drinking. If or when the water in an indoor pool has a temperature below 68° to 72°, it is desirable to heat it; also to heat it for outdoor pools except that it is not desirable to have it warmer than the air above it.

Recirculating Equipment

In a recirculating system it is necessary to supply a pump for circulating the water from the pool, through the filters and back to the pool again. The capacity of the pump should be sufficient to remove the entire contents of the pool in about 6 hours (see the October issue) against the total pressure of pipe friction, filter, heater (if used), plus depth of tank (in effect when filling an empty tank). If there is no wash-water tank, the pump must be capable of providing wash water at a rate of about 10 gal. per minute per square foot of area of one filter. It is generally economical to provide at least three filters, so that the area of one filter will be small enough to permit a pump of capacity to meet the first requirement to meet the second also. If this requires too great expense for filters, it may be more economical to provide an elevated wash water tank of a capacity to hold about 10 to 15 minutes' supply of wash water, the tank being refilled by the pump after each washing. If a supply of potable water under sufficient pressure

is available, it may be cheaper to use this. The wash water and the flow for the first two or three minutes after washing must be wasted, and the amount replaced with fresh water.

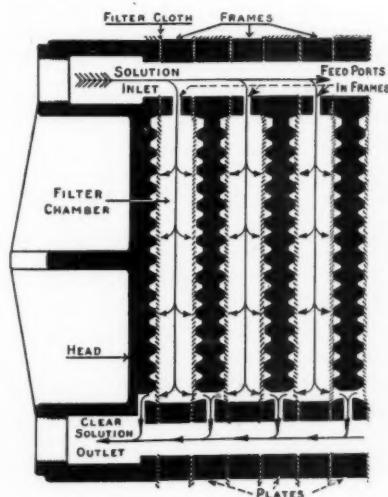
A single-stage centrifugal pump, operated by motor where current is available, is generally the most suitable. It should be durable and efficient and have the other qualifications of a first class water works pump operating against a low head. A hair catcher is generally placed between pool and pump.

Any convenient device may be used for heating the water. If there is a steam plant in the building, the water can be passed through a closed tank, between filter and pool, in which is a coil of pipe through which steam is passed; the rate of flow of steam through the coil being regulated by hand, or automatically by a thermostat controlled by the heat of the pool water. On a bypass around the heating tank may be provided, only part of the water being heated, the amount of this being regulated by valves on bypass and tank feed. Or a gas heater may be used; or, where current is cheap, an electric heater.

Filtration

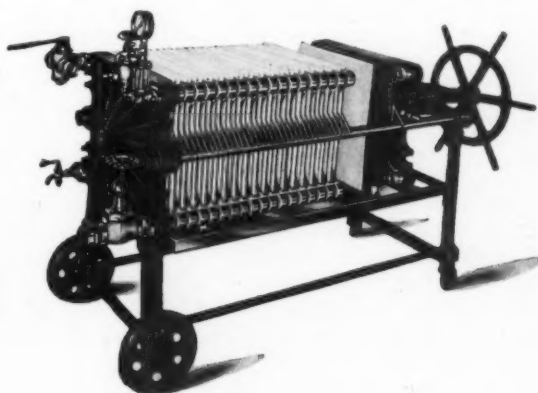
Filtration is generally effected by a rapid sand filter of the type used for public water supplies. This can be either a pressure or gravity type, but unless it is practicable to place the filter low enough to receive water from the pool by gravity, or high enough to feed it to the pool by gravity (as it seldom is), the pressure type is used. The water to be filtered is coagulated, and feeders for supplying the alum or other coagulant are necessary. Unless the water flows to the filter by gravity, the coagulant must be fed to it under pressure. If the filtered water is not alkaline in reaction, soda ash or other alkaline material should be used to make it so, being added ahead of the filter.

Filters adapted especially for swimming pools are



At left—Sectional view of a Shriver filter, showing plates or frames, filter cloth placing and flow of water.

At right—View of a Selts filter, with one section opened, with paper pad used as a filter medium.



furnished by the Everson Manufacturing Co., International Filter Co., Wm. B. Scaife & Sons Co., Permutit Co., Roberts Filter Mfg. Co., E. W. Bacharach Co., Norwood Engineering Co.

Another type of filter that can be used for this purpose consists of a number of cells containing plates of porous material held in a frame, through which the water passes under pressure. Two of these—the Shriver and the Seitz, were described in PUBLIC WORKS for August, page 20.

Sterilization

After filtering, the water is sterilized by use of liquid chlorine, hypochlorite, ozone, ultra-violet ray or the katadyn process. Liquid chlorine is believed to be the cheapest, for large pools at least. Special equipment is necessary for feeding this, such as is furnished by Wallace & Tiernan, Pardee Engineering Co., Everson Manufacturing Co., and the Filchlor Co. Several pools are being treated with ammonia and chlorine to enable the effect of the latter to continue for some time after reaching the pool. Sodium hypochlorite may be dissolved and the solution fed by a solution feed. While the cost per unit of chlorine is greater and the operation of the apparatus is less simple, the equipment is less expensive and the effect of the chlorine is said to continue longer in the water. (Conditions affecting sterilization in a pool and in a public water supply differ. In the latter the water, once sterile, is not subject to later pollution after the mains and any sediment in them once are sterilized; while in the pool, the water is being polluted continually during use.)

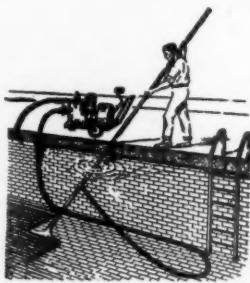
The Everson "electric chlorination" and the Marsh "electro-chlorinator" are used in some cases for manufacturing hypochlorite from a solution of salt (NaCl) and electricity, feeding it as made, the rate of production being regulated by the amount of current used. The former is made with capacities up to 12 lbs. of available chlorine in 24 hrs.

Ozone sterilizes by its high oxidizing power. It is made by discharging an electric arc in air and is at once mixed with water as the two are brought in contact in a steel tower. In ultra-violet ray sterilization, thin films of water which is free of all turbidity are passed across quartz tubes containing ultra-violet ray sources, when bacteria are killed by the rays. The chief advantage claimed for these is that no chemicals are introduced into the water. The latter, which are in use in several pools, are furnished by the R. U. V. Engineering Corp. We believe that there are no ozone sterilizers in use in the United States.

The Katadyn (ionic silver) method of sterilization consists of causing water to take into solution minute quantities of silver (5 parts per 100 million is said to kill all germs) by placing in it several plates of silver and passing direct electric current between these through the water. This is the most recent method introduced in this country and only a few have yet been installed by the Katadyn Process Corporation.

Suction Cleaner

Some sediment may collect on the bottom and sides of the pool, and to remove this, a suction cleaner is desirable. This is similar to a vacuum cleaner on the end of a long pole and connected by hose to a fitting in the wall of



Portable pool cleaner and method of using it.

the pool, which in turn is connected to the pump suction. Everson makes a portable suction cleaner—a small portable pump with the cleaner hose on the suction, and on the discharge another hose which discharges into the scum gutter or other drain; the pump being driven by either electric or gasoline motor.

Other portable appliances for convenience of bathers, but not a part of the pool structure, are furnished by dealers in pool equipment.

New Soft Water Plant for Arcadia, Fla.

A new filtration plant for the city of Arcadia, Fla., is now nearing completion. The plant, which has a capacity of about one million gallons per day, draws its supply from the Peace river. In conjunction with the plant, new construction includes about two miles of new mains and 21 additional fire hydrants. The construction was financed through the PWA by a loan and grant for \$90,000, of which \$50,000 is to be repaid over a 25-year period with interest at 4%. Repayments will be at the rate of \$1,000 per year for the first five years; \$2,000 per year for the next fifteen years; and \$3,000 per year for the final five years. The plant was designed by C. K. Dodd.

In the past, the city has been supplied with water from artesian wells from 250 to 400 feet deep, but the water contained an objectionable amount of iron, alumina and magnesium, and fluorine has been noticeable at times.

The present revenues of the water department amount to about \$14,000 per year; with the new plant in operation, it is estimated that the total cost of maintenance will be about \$6,500 annually, while the sinking fund requirements will not total more than \$3,600 in any year.

U. S. Forest Service Experiments With Stabilized Roads

A network of over 70,000 miles of woodland roads throughout our National Forests play an important part in the fire protection work of the U. S. Forest Service. Very light traffic justifies only a low-cost soil type road, but the economic value of the forests necessitates that these roads be kept passable at all times.

Most of the roads now in use are of the sand-clay or gravel-sand-clay type. Such materials, as found in nature, are generally quite unsuited to withstand weathering and erosion. Too often, the roads are practically impassable during wet seasons and, even in dry weather, rapid disintegration of the surface makes them unsatisfactory for traffic.

The Forest Service has been conducting a series of experiments with soil road stabilization on the Cherokee National Forest, near Gainesville, Georgia. The experiment includes scientifically selected and graded sand-clay and gravel-sand-clay surfacing, with and without chemical admixtures. Test sections were constructed early in the fall of 1935.

The effect of calcium chloride used as an admixture in preserving the stability of the road surface was very evident eight months later, in the spring. The untreated sections were becoming dusty and rough and there was evidence of appreciable loss of material, while chemically treated sections were smooth and dustless and contained no loose material; are quite impervious to rains and rutting, and their high resistance to disintegration effects considerable savings in upkeep and depreciation.

LAYING *the* FOUNDATION

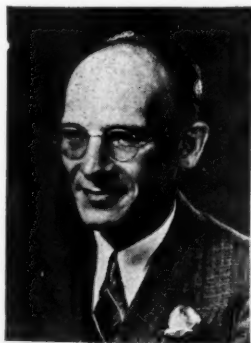
for the

NEW YEAR

• • ▲ • •

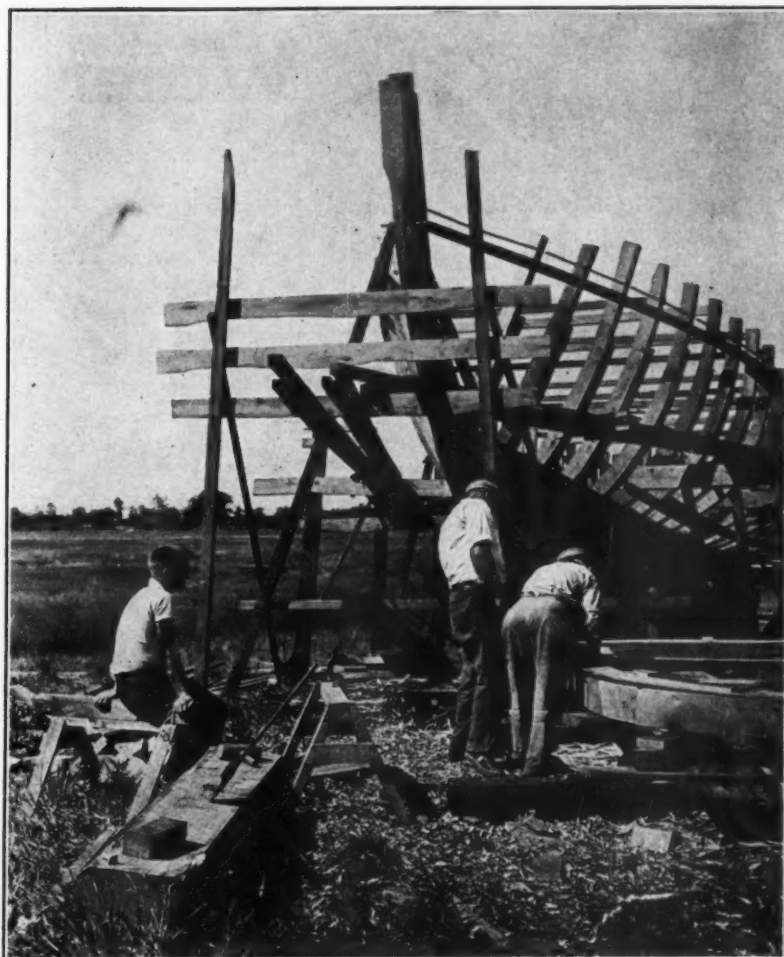
For the past seven years we have endeavored to bring before the Members of the water works fraternity the message of AQUA NUCHAR and through its application the furnishing of a water that is palatable. In that period close to one thousand plants have used this product—some daily, others only intermittently, and then when faced with the severest taste and odor conditions. We feel convinced there is a dose of AQUA NUCHAR that will eliminate these tastes even under the worst conditions but in so doing, on the surface, the cost seems exceedingly high and has frequently been the means of not considering its application.

Our recommendation for the New Year is that consideration be given to the daily application of AQUA NUCHAR in small dosages, so that the Plant will be properly seeded and a gradual improvement in the water so that when severe tastes and odors are encountered in the raw water supply all that is necessary is to step up the dose to a point sufficiently large enough to eliminate these tastes. Actual experience has shown that this is economical and from a survey made of a number of plants—and using the per capita consumption of 100 gallons daily, it is estimated that the per capita cost of furnishing palatable drinking water using AQUA NUCHAR is slightly over 3c per year.



E. A. SIGWORTH
TECHNICAL SALES STAFF

During the past seven years, since AQUA NUCHAR has been introduced, we realize fully that it was during a period when many of the Municipalities have been pressed for funds and all economical measures adopted to keep within the budget re-



quirements. This period is gradually passing and more funds are available. We feel now is the time for the furnishing of a palatable water, since you are already furnishing one that is safe.

You have noted from the daily press the rising prices in practically all commodities and we know that you will be pleased to learn that AQUA NUCHAR will be available for the calendar year 1937 at prices no higher than have prevailed in the past.



INDUSTRIAL CHEMICAL SALES

Division West Virginia Pulp and Paper Co.

230 Park Avenue 205 West Wacker Dr. 418 Schofield Bldg.
New York Chicago, Ill. Cleveland, Ohio

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

Dam designing for Hartford's Bills Brook dam was preceded by wash borings to determine depth of overburden; core borings to determine character of rock floor; test pits to determine and check on quality of overburden and ground water behavior; geophysical survey to determine approximate contour of the rock floor; clearing of land to better expose the peculiar surface features of the site; detailed field examination of the geologic features and rock formations and other materials; and laboratory tests on materials, such as specific gravity, permeability and mechanical analysis. The aim was, to determine the physical feasibility of building an earth dam on this site to hold at least 110 ft. of water, the suitability of the structural materials available locally, the proper type of earth dam and economic location, the necessity for a core wall and for grouting of the rock foundation. The geophysical survey method by electrical resistances was used, as performed by the Schlumberger Electrical Prospecting Methods, revealing conditions that otherwise would not have been learned.^{B19}

State control of the use of the waters of New Jersey is exercised through five agencies. The State Dept. of Health has approval of potability of all public supplies and supervision of their operation; also authority to prevent pollution of streams. The Board of Public Utility Commissioners fixes rates of all private water companies and requires an annual report of financial transactions and physical assets from all water supplies, both public and private. The North Jersey District Water Supply Commission controls and operates the Wanaque supply for eight participating municipalities and their customers. The Passaic Valley Water Commission operates water supply system of the three cities of Paterson, Passaic and Clifton and their customers. The State Water Policy Commission has approval of all diversion of water, stream control and encroachments, and collection of excess diversion tax (on water used in excess of 100 gpd per capita). "The predominant control of water rights by private interests no longer exists."^{A71}

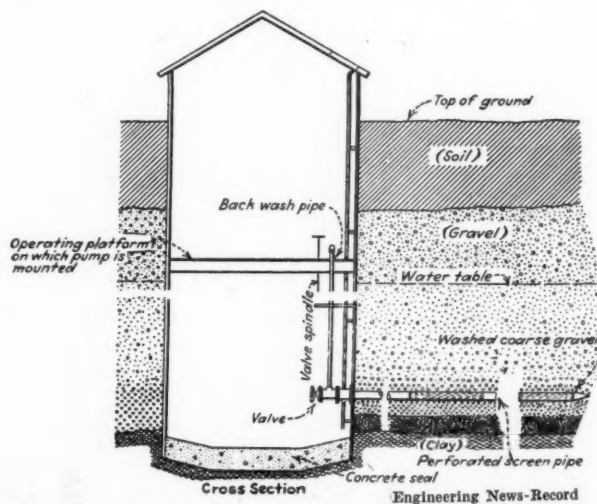
Underground water collection is employed for London's water supply by a method developed in this country; the general principle is old but many of the details are new. A shaft 12½ ft. in diameter was sunk 22 ft. through alluvial sand and gravel into a thick bed of clay, the bottom sealed with concrete, and nine radiating 7" screen pipes forced horizontally into the water-bearing stratum, through ports in the wall of the shaft, some a length of 165 ft. This supplied 1,800,000 gal. daily during a drought. Novel features include a perforated boring head on the end of the screen pipe; a solid pipe inside the screen pipe is connected to this head by a sliding packing so that water can be forced through the boring head while it is being jacked forward. Each screen pipe is provided with a valve operated from the surface; also with a back-wash pipe, by means of which

water can be forced out and drawn in through the screen openings, washing the fine soil out of the surrounding sand, as is done in developing a gravel-wall well.^{E46}

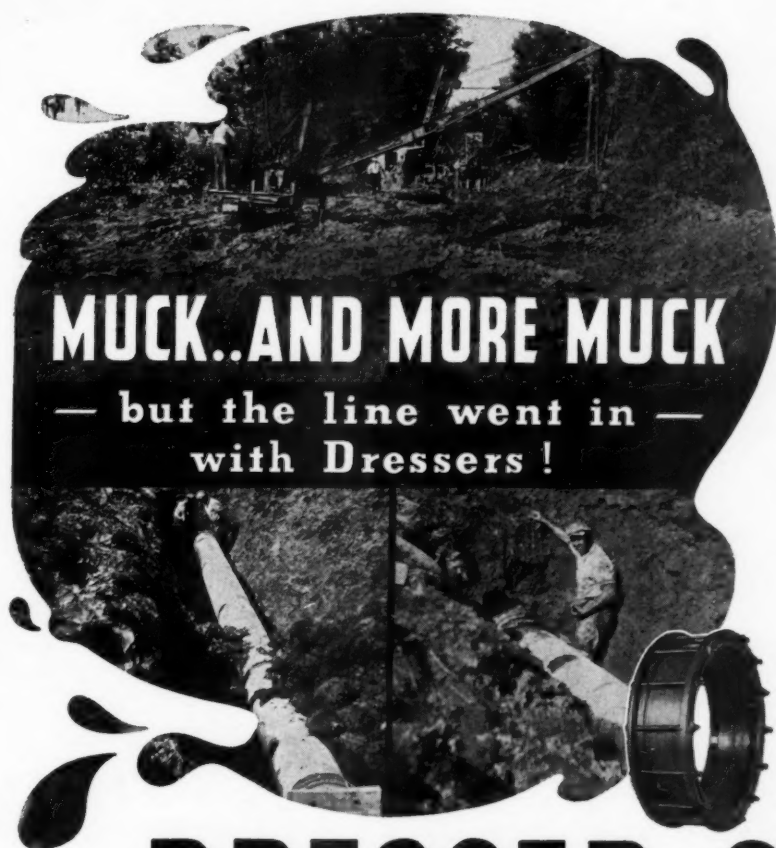
Air pockets in pipes reduce capacity more than is commonly realized, especially in lines where there are no service or hydrant connections. One 36" pipe gave a coefficient of only 15, but when an air valve was inserted at a peak 300 ft. from the reservoir the coefficient became 116. "A pipe may be as smooth as glass on the interior surface, and yet if there is an opportunity for an air pocket to form, the effect is the same as if the pipe were badly corroded."^{F67}

Automatic control is considered successful by the California Water Service Co. Of 140 pump stations in 21 water systems, 104 are automatically controlled, and of the remaining 36, 20 are used only as standby or for peak loads. On the entire system there are only 8 pump stations where a full shift of operators is kept on duty, and three of these are connected with purification plants which require the continued services of an attendant and a fourth is operated only 4 or 5 months of the year and plans are under way for changing one of the remaining 4 to automatic control. The total cost of maintenance of the 267 pumping units in the 140 stations, including all automatic control, is approximately 0.75% of the capital invested in electric power pumping equipment. (There are three steam plants maintained as standby equipment.) "We operate three general types of automatic control: (1) float switch, (2) pressure or hydrostatic control, (3) electric time clock. These three are combined in various manners."^{G23}

Filter bottoms at Oakland, Calif., are divided into bins having areas of 6 to 10 sq. ft. by means of redwood partitions extending from the filter floor to the



Collecting underground water by horizontal screen pipes.



MUCK..AND MORE MUCK

— but the line went in —
with Dressers!

NO one would deliberately pick a swampy right-of-way for a pipe line. Yet that was the unavoidable condition encountered on the 19-mile water-supply line from Lake Canandaigua to Palmyra, N. Y. And, so, straight through the muck and marshes the workmen went—simply *assembling* (NOT fabricating) the joints in watery ditches . . . and making a bottle-tight job of it, too! ● That's one of the great advantages of using Dresser Couplings—you don't need to worry about the kind of terrain or weather. ● A mile of this Palmyra line extends into the lake. Full details of the special Dresser Couplings used on this intake section are available on request. Also ask for folder No. 355, which gives you the story of Dresser permanent tightness, flexibility, simplicity, strength, and *true* economy.

S. R. DRESSER MFG. COMPANY • BRADFORD, PA.

In Canada: Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

DRESSER COUPLINGS

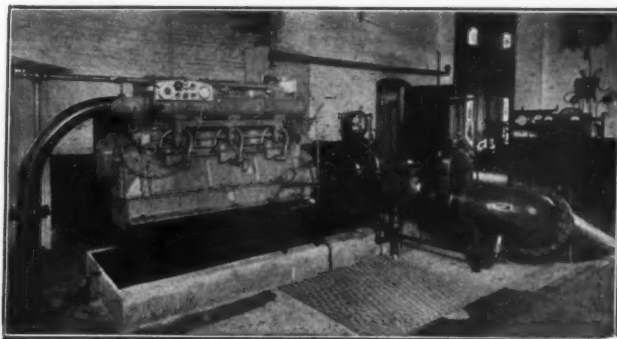
IN EMERGENCY ENGINES . . . THE DIFFERENCE *between an overspeeded engine and*

Sterling
High
Duty



Internal
Combustion
Engines

is usually discernible in the valves. Overspeeded engines employ large cumbersome valves which absorb heat and pound the valve seat. Sterling valves are less than 2½" diameter and, where increased valve area is needed, two valves are used. The dual valve principle was developed by Sterling for standby service.



In the Spring Hill Station at Mobile, Ala., a Sterling Viking 6 cylinder 425 H.P. engine drives a DeLaval pump of 7½ million gallons per day capacity, at 1200 R.P.M. Installation by Burford, Hall & Smith, for standby service.

Sterling engines — for peak load and standby.

GAS—GASOLINE—OIL ENGINES

STERLING ENGINE COMPANY

Home Office and Plant
1270 NIAGARA ST., BUFFALO, N. Y.

DEPT. C-5

Branch Office
900 CHRYSLER BLDG., NEW YORK, N. Y.

MH CUTTING-IN TEES
CUT COSTS

Fig. 286

SO DO—

Fig. 72

Tapping Valves & Sleeves
(With Any Standard Make Tapping Machine)

Fig. 73

M & H VALVE & FITTINGS CO.
ANNISTON, ALA.
GET OUR PAMPHLET 33

THAWS FROZEN PIPES
IN 1 MINUTE!
Only \$39.25
COMPLETE

Amazing! An **ELECTRIC PIPE THAWER** that sells for only \$39.25 complete! Now you can handle all rush complaints of frozen pipes this winter—easily, quickly, safely, economically! The **RELIANCE** Pipe Thawer plugs into any light socket. Attach terminals to exposed sections of pipe and in **ONE MINUTE** the entire length of pipe thaws! **NO DIGGING** in streets, through hard ground, lawns, flower beds, etc. **NO TEARING** down walls, floors, etc., to get to pipes. No danger of bursted pipes, or starting fires. The **RELIANCE** does work of machines costing \$165 to \$3,000. Works on 110 or 220 volt, 50 or 60 cycle alternating current. Easily portable, weighs only 90 lbs. Get ready for coldest winter predicted in 50 years! Sold on money-back guarantee.

FREE! Write at once for complete free details! No obligation.
COMMONWEALTH MANUFACTURING CORP.
3785 Beechmont Avenue, Dept. P-710, Cincinnati, O.

TIME IS SAVED • HAZARDS CUT
by this BETTER JOINTING COMPOUND

• When you joint your Bell and Spigot Pipe with **Tegul-MINERALEAD** the trench can be back-filled almost at once, for initial leakage will be cut as much as 96% • Time will be saved—traffic hazards minimized • Rain or flood won't hurt this Ingot-form compound, nor will the contractor need to worry about change of composition en route to the job • And your joints will hold fast under even the toughest conditions. • For more information, write

The **ATLAS MINERAL**
PRODUCTS Company
of Pennsylvania
Mertztown, Pennsylvania

Tegul-
MINERALEAD

When writing, we will appreciate your mentioning **PUBLIC WORKS**.

bottom of the filter sand—18" to 22"—in which bins the graded gravel is placed and through which the washwater pipes run. The aim is to prevent lateral flow of wash water through the coarse gravel. "The important thing is to space the baffles in both directions so that the cells are of equal area and enclose the same number of pipe perforations." This plan was first installed in the Upper San Leandro filters in 1932, where previously the gravel beds had been badly disrupted, since which the gravel has remained exactly as placed and the washing has been uniform throughout.^{A118}

Iron in Mokelumna water, ranging from 0.09 to 0.18 ppm, serves as a coagulant in the filtration plant at Oakland, Calif., the water being aerated about 8 miles upstream from the plant as a result of which a perfect iron floc forms in the filters, which aids in the removal of the finely suspended matter, no other coagulant being used. Turbidity of the raw water ranges from 1 to 3 ppm (maximum of 7 ppm has been treated) and that of the filtered water 0.1 to 0.3 ppm.^{A118}

Iron removal without aeration is in service at the Queens, New York, pumping station where, in 1935, well water had its iron content reduced from an average of 3.40 ppm to 0.22 ppm; at the same time the free CO₂ was reduced from 35.7 to 0.0; hardness (calcium carbonate) was increased from 26 ppm to 40 and total solids from 71 to 100. The filtered water contains no dissolved oxygen and no free CO₂ and enters the mains practically non-corrosive. The plant adds sufficient lime hydrate to neutralize the free carbonic acid to form calcium bicarbonate and produce a pH slightly over 8. Provision was made to introduce air to produce an oxygen content of 1 ppm, but has not been used. A reaction chamber gives 10 minutes' detention. The sand filter has a capacity of 2 gal. per square foot against a pressure of 60 pounds, sand having an effective size of 0.40 to 0.50 mm and a uniformity coefficient less than 1.60. The lime hydrate must be low in magnesia.^{A118}

Boron in a strictly domestic water supply is believed to have little significance. But when the water is used for irrigation, the presence of too much or too little boron may be very important. One ppm or more causes leaf burn and partial defoliation in lemon and other citrus trees. Deficiency causes shriveling of sugar beets. Asparagus will stand 100 ppm before showing severe injury. "There is no practical method for removing large quantities of boron from water."^{A107}

Fluorine enters the body chiefly in water; possibly also in some vegetable products. It is believed by many to cause mottling of teeth, but "more information is needed on a few remaining doubtful points of the mottled enamel problem before an intelligent estimate of the potential toxicity of a given amount of fluoride in the water supply can be made and a safe limit be established."^{A108}

Bibliography of Recent Waterworks Literature

c, Indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article

A Journal, American Water Works Association
October

107. t. Methods of Testing and Significance of Boron in Water. By R. L. Derby, pp. 1449-1455.
108. t. Methods of Testing and Significance of Fluorine and Fluorides in Water Supplies. By J. M. Sanchis, pp. 1456-1468.
109. Plankton and Insect Larvae Control in California Waters. By G. E. Arnold, pp. 1469-1479.
110. Iron and Manganese Removal by Zeolites and Manganese Zeolite Processes. By E. Nordell, pp. 1480-1487.

111. The Use of Beds of Manganese Ore in Iron and Manganese Removal. By W. G. Kirchoffer, pp. 1488-1499.
112. f. The Analytical Control of Anti-Corrosion Water Treatment. By W. F. Langeller, pp. 1500-1521.
113. Mixing. By C. M. Hoskinson, pp. 1522-1532.
114. Coagulation. By K. W. Brown, pp. 1533-1540.
115. Filter Design as Related to Operation. By H. N. Jenks, pp. 1541-1550.
116. Orinda Filtration Plant of the East Bay Municipal Utility District, Oakland, Calif. By J. D. De Costa, pp. 1551-1570.
117. Maintenance of Filter Plant Equipment. By J. L. Perhab, pp. 1571-1576.
118. Iron Removal Without Aeration. The Precipitation of Ferrous Carbonate in a Closed System. By F. E. Hale, pp. 1577-1590.
119. Developments in Raw Water Preparation and the Use of Chlorinated Copperas at Richmond. By M. C. Smith, pp. 1591-1603.
120. Dams, Pipe Lines and Pumping. By S. B. Morris, pp. 1604-1616.
121. The Past Year in the Distribution Field. By W. W. Brush, pp. 1617-1620.
122. Kinks, Gadgets and Ideas. By F. E. Stuart, pp. 1621-1630.

B Journal, New England Water Works Ass'n

September

12. Required Fire Flows. By P. C. Charnock, pp. 249-254.
13. Automatic Sprinkler Systems and Their Water Supplies. By H. E. Halpin, pp. 255-266.
14. Cushnoc Heights High Service, Augusta Water Dist. By S. S. Anthony, pp. 267-273.
15. Distribution System Problems of the New Haven Water Co. By E. E. Minor, pp. 274-282.
16. Remodeled Pumping Station and New Diesel Engine, Pennichuck Water Works, Nashua, N. H. By W. F. Sullivan, pp. 283-290.
17. Brook Diversion to Improve the Manchester, N. H., Water Supply. By P. A. Shaw, pp. 291-298.
18. Frost Penetration as Affected by Weather and Snow Conditions. By H. U. Fuller, pp. 299-301.
19. Design of Bills Brook Dam, Hartford W. W. By W. Dornbaum, pp. 302-314.
20. New Water Supply System and Filter Plant at Hinsdale, N. H. By A. L. Shaw, pp. 315-324.
21. Filtration Plant of the Mystic Valley Water Co. By W. H. Chase and T. B. Ray, pp. 325-330.
22. The Water System of Concord, N. H. By P. R. Sanders, pp. 331-333.
23. Public Waters Pollution Control in New Hampshire. By C. D. Howard, pp. 334-339.
24. Changing a Town from Flat Rates to Metered Rates. By D. L. Agnew, pp. 340-343.

E Engineering News-Record

October 22

46. London Water Supply Augmented by New Underground System. By R. Nebolsine, pp. 576-577.

October 29

47. Second Steel-Faced Dam Built for Colorado Springs, pp. 599-603.
48. Extensive Improvements Aid Buffalo Water System, pp. 615-616.

November 5

49. Cut-and-Cover Conduit, Colorado River Aqueduct. By D. B. Gumensky, pp. 633-635.
50. Hydrologic Data Collection Recommended by Water Resources Committee, pp. 641-643.

F Water Works Engineering

October 28

81. Water Supply Problems of a New England Town. By E. C. Sanderson, pp. 1420-1423.
82. p. Filter Bed Troubles and Their Elimination. By J. R. Baylis, pp. 1424-1428.
83. Laboratory Control: Tests for Turbidity. By C. R. Cox, pp. 1429-1431.

November 11

84. p. Denver's New Water Treatment Plant. By L. R. Howson, pp. 1480-1485.
85. p. Filter Bed Troubles and Their Elimination. By J. R. Baylis, pp. 1486-1487.
86. Laboratory Control: Tests for Turbidity. By C. R. Cox, pp. 1488-1490.

G Water Works & Sewerage

October

37. Chicago's New Cermak Pumping Station. By L. D. Gayton, pp. 365-369.
38. p. Corrosive Action of Various Types of Water on Household Plumbing. By C. P. Hoover, pp. 384-387.

J American City

November

21. New Water Supply Method Used in England and Portugal, pp. 43-45.

L Civil Engineering

November

8. Experiments Aid in Design at Grand Coulee Dam. By J. E. Warnock, pp. 737-741.
9. Use of Models at Fort Peck Dam. By G. A. Hathaway, pp. 741-745.
10. Grouting Boulder Dam Tunnels. V. L. Minear, pp. 751-755.

P Public Works

November

33. p. Coating for Steel Water Mains in Los Angeles, pp. 11-12.
34. New Water Works Intake Saves \$1,500 Annually. By T. E. Watford, pp. 13-14.
35. p. Catalytic Removal of Manganese at Brainerd, p. 22.
36. Suggestions for Designing Swimming Pools, pp. 24-25.
37. n. Airway Markings for Water Tanks, p. 33.

S Construction Methods

November

5. Heavy Sheepfoot Tampers on San Gabriel Dam, p. 25.

T Earth Movers for Earthfill Dams, pp. 28-32.

Taste & Odor Control

October

- Experiences With the Application of Activated Carbon in Reservoirs. By E. A. Sigworth, pp. 1-3.



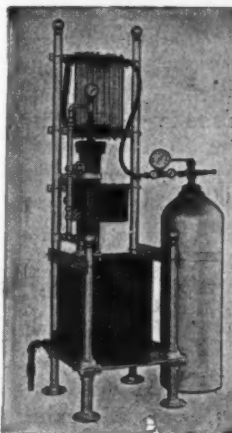
Dependable service from water producing equipment is demanded by all Municipal Executives. For more than fifty-three years Layne Wells and Pumps have been built to stand the unmerciful test of time. Today, their performance record remains unbroken—a commendable tribute to skillful engineering and successful installation methods.

The world-wide experience of our hydrological engineers is offered to all who face water production problems. No obligation. For illustrated literature, write Layne & Bowler, Inc., Dept. W, Memphis, Tenn.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO., STUTTGART, ARK.
—LAYNE-ATLANTIC CO., NORFOLK, VA.—
LAYNE-CENTRAL CO., MEMPHIS, TENN.—
LAYNE-NORTHERN CO., INC., MILWAUKEE, IND.—
LAYNE-LOUISIANA CO., INC., LAKE CHARLES, LA.—
LAYNE-NEW YORK CO., INC., NEW YORK CITY—
LAYNE-NORTH-WEST CO., MILWAUKEE, WIS.—
THE LAYNE-OHIO CO., COLUMBUS, OHIO—
LAYNE-BOWLER NEW ENGLAND CO., BOSTON, MASS.—
LAYNE-TEXAS CO., HOUSTON, TEX.—
LAYNE-WESTERN CO., KANSAS CITY, MO.—
CHICAGO, ILL., AND MINNEAPOLIS, MINN.—
INTERNATIONAL WATER SUPPLY LTD., FORT ERIC, N. ONTARIO, CANADA.

LAYNE PUMPS LAYNE WELL WATER SYSTEMS



for Water and Sewage Treatment
1 to 100 lbs. of Chlorine per day . . .
\$375.00 and up

EVERSON Metered-Feed CHLORINATORS

Here at last is a reasonably priced, accurate, chlorinator that anyone can operate safely. EVERSON Model G Series Chlorinator offering for the first time: Any delivery from 1 to 100 lbs. of chlorine per 24 hours; Metered-feed; Intimate mixture of gas in water-sealed, self-venting chamber; Protection against back-flooding by an automatic vacuum break, non-corrosion line and valves (Guaranteed against corrosion for 1 year) divided into standard replaceable units for safe, easy-cleaning and maintenance; Reliable equipment designed, manufactured and guaranteed by "The Swimming Pool People" specialists in water conditioning for two generations. Write for Bulletin "G"

EVERSON MANUFACTURING CO.
629½ W. Lake St., Chicago, U. S. A.

HAPPINESS AHEAD

Fred Stuart
wishes you
A Merry Christmas

Al Brumley
wishes you
A Happy New Year



Activated Alum Corp.

Main Sales Office: 80 BROAD STREET, NEW YORK

When writing, we will appreciate your mentioning PUBLIC WORKS.

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

The Digestion Tank

Stream pollution in Oregon is not as great as in most states, and no heavily polluted streams are used for water supply. But limiting of pollution is undertaken for the benefit of the salmon industry and for the esthetic and recreational values restored to the streams. "The people of Oregon realize that recreational resources constitute one of the state's major assets, and that the construction and efficient operation of sewage treatment plants will result not only in the protection of water supplies and aquatic life but in the preservation of recreational values as well." Most of the treatment plants are in the valley of the Willamette river, which reaches a minimum of 4,000 cfs at Salem at the time of maximum industrial pollution, and its oxygen content then is seriously depleted.^{L5, 6 & 7}

Pond oxidation of sedimentation tank effluent has been employed for 2½ years at Texas A. & M. College, 300,000 gpd, averaging 370 ppm of B.O.D. and 125 ppm suspended solids being discharged into an artificial lake covering 14 acres and holding 73 acre-feet. Filled first with rain water, the lake has received sewage continuously since April, 1934, and operated satisfactorily, although for a time the settled sewage entering had a B.O.D. of 475 ppm due to abattoir waste. Sewage is discharged into the lake through numerous 1" outlets throughout its length, none within 75' of the shore. The water swarms with top minnows, which prevent mosquito breeding. Oxygen is supplied at the rate of about 50 lb. per acre per day, much the larger part by the life processes of the flora. Effluent from the lake is drawn from the bottom and aerated by spraying. The cost per year is \$9.42 per mg, or \$4.04 per 1,000 lbs. of B.O.D. removed, 75% of which is fixed charges.^{E27}

The Mogden purification works, treating sewage from 2,000,000 population located in 16 communities in the West Middlesex (England) district, costing about \$12,000,000, was opened Oct. 23. Half the cost was furnished by a government grant. It comprises sedimentation, activated sludge treatment, thickening and sludge digestion with gas utilization for operating the plant. An abstract of the article will appear in PUBLIC WORKS.^{D49&50}

Storm overflows with side weirs permit great increase of flow in the foul-water sewer below as the storm-water overflow increases. In one case in Birmingham, England, when there was a flow 6" deep over the side weir (which was 12.6" above the invert), the flow in the foul sewer below was 133% in excess of that desired. Satisfactory results have been obtained by use of "a combination of side weir and oblique weir, so arranged that the foul-water channel is deflected off the line of the incoming sewer, which is completely covered by the oblique weir." Then "the velocity of approach in the incoming sewer is utilized to overflow the bulk of the excessive storm water over the oblique weir." Approximately 70% of the overflow passes over the

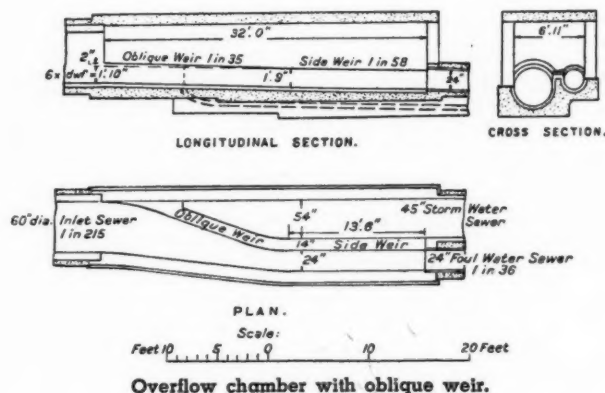
oblique weir. Details of design of such a weir are described in the article.^{D43}

Activating diluted sewage at Rotherham, England, has permitted increasing the amount activated by about 50% and eliminated all bulking and other troubles. About half the sewage was treated on trickling filters and half by activated sludge method, and both were overloaded. Now a "substantial volume" of filter effluent which has passed through the humus tanks is mixed with the primary settlement tank effluent and the mixture flows through the aeration tank, with such good results that the amount treated by activation is increased 50% with more satisfactory results, thus relieving the trickling filters so that they operate more satisfactorily. The reason is not known, but may be due to mere dilution of settled effluent, or possibly to oxidation of the organic matter by the nitrates and nitrites present in the filter effluent.^{D51}

An activated sludge plant for 4500 population at Ambler, Pa., comprises screens, 2 primary settling tanks and final settling tanks, each with straight-line sludge collectors, 6 aeration tanks with mechanical aerators, chlorine contact chamber, sludge conditioning tank, 2 heated sludge digestion tanks, a steel gas holder and glass-covered sludge drying bed; a gas-fired boiler; 2 variable-speed sewage pumps (125 to 500 gpm by four steps) automatically operated; 2 75 gpm activated sludge return pumps, one constant-speed plunger, one variable-speed 10 to 75 gpm; 2 150 gpm raw sludge pumps.^{C51}

Dearborn treatment plants have been changed more or less recently and at present, at the East Side plant, screenings from mechanically cleaned bar screens with ¾" clear openings are carried by belt conveyor to a Jeffrey grinder and returned to the raw sewage. Sludge from primary sedimentation is pumped 4 miles to the West Side plant with a 2% to 8% solids concentration.

At the West Side plant ferric chloride is fed by Omega precision-type feeders and lime by Omega bucket elevator type. Solutions are such that one gallon



contains 1 lb. of Fe Cl_3 and 1 lb. of CaO respectively. Agitation in the mixing chamber is by air, 140 cfm through aloxite diffuser tubes along one side of the mixing chamber; the dosed sewage being mixed in a Dorr flocculator for 20 min. at 1.8 ft. per second. For mixing chemicals with sludge, two bucket elevators carry the sludge to 2 rotary drum mixers similar to concrete mixers where it is mixed 10 min., chemicals being added in proportion to the number of bucket loads placed in mixer. Ferric chloride, bought in car-load lots, is stored in 12,000 gal. rubber-lined tanks diluted to 4 lb. per gal.; and is moved to feeding points by compressed air. Rubber hose is used for both ferric chloride and lime. In the vacuum filter the level of sludge in the pan is kept constant by manual control of a Reeves variable-speed transmission which controls the speed of the sludge elevator. For sludge conditioning, ferric chloride is used at rate of 2% of dry solids in the sludge, and calcium oxide at 11.8%. The belt conveyor removing the sludge cake passes over a weightometer which indicates, records and totalizes the amount. Costs per million gallons of sewage at the West Side plant for 12 months, including operation, maintenance and fixed charges, were \$2.99 for sludge filtration, \$1.99 for incineration, 37 cts. for idle time and 22 cts. for ash disposal, total of \$5.57. Of this \$3.81 was for operation, 54 cts. for maintenance and \$1.22 fixed charges. "Sludge disposal by means of vacuum filtration and incineration is highly satisfactory and exceptionally economical."^{C50}

Sedimentation tanks should be fed continuously, when sewage is pumped to them, which requires pump which can be operated at minimum rate of night flow. "Intermittent pumping to a settling tank is especially undesirable for a level bottom, shallow settling tank, and it would have far less effect upon the efficiency of the tank if the tank were deeper and had a sloping bottom with the maximum depth at the outlet end."^{C49}

Gas engines operated by sludge gas at Springfield, Ill., after nearly four years' operation have apparently demonstrated that they will furnish 85% of the air compression required for the activated sludge treatment, while the waste heat from the engines will keep the digestion tanks at 90° during zero weather. Allowing for labor, materials and interest, they have given a net savings of \$8,420, sufficient to pay the cost and interest on same every 2.8 years. They need practically no attention except grinding valves 3 or 4 times a year and pulling pistons at about 18-month intervals. The engines show no depreciation—operate better than when installed. They have run 5 months without a shut-down.

There are in service 3 300hp engines at Coney Island; 835hp at Peoria; 600hp at Topeka; 337hp at Springfield, Ill.; 300hp at Durham, N. C., and at Cedar Rapids, Ia.; 200hp at Los Angeles, Calif.; and many others of 150 to 15hp, the latter at Edwardsville, Ill.^{C50}

An engine that will use gasoline will run with sludge gas if a gas-air mixing valve is substituted for the carburetor. A mixture of 7 cu. ft. of air to one of gas is common. As sludge gas is likely to be dirty and saturated with water vapor, an ample drip trap should be placed at the lowest point in the gas line. To prevent gumming up of mixing valves, there should be no small orifices and the mixing valve should be carefully adjusted. Sludge gas burns slowly and should be fired several degrees ahead of dead center. To eliminate burnt valves, these may be made of combinations of silicon and chromium, particularly in the heads. To insure

Use PFT Equipment in Your Sewage Treatment Plant

Write for Latest Bulletins

PACIFIC FLUSH TANK COMPANY
Designers & Manufacturers of Sewerage and Sewage Treatment Equipment
4341 RAVENSWOOD AVE. CHICAGO, ILL. EXCLUSIVELY SINCE 1893
441 LEXINGTON AVE. NEW YORK, N. Y.



SLUDGE BED Glass Overs

For Sewage Disposal Plants

Lord & Burnham Co.

IRVINGTON, N. Y.

Assurance

You know a Friez instrument is the best—that each instrument has behind it sixty years of constant effort to assure the performance you expect of it.

STANDARD RAIN GAGES WATER LEVEL RECORDERS



Instruments for Recording all Conditions of Air and Weather
JULIEN P. FRIEZ & SONS, INC.
BELFORT LABORATORIES BALTIMORE, MD.

QUINN PIPE FORMS

HAND or WET PROCESS

Make concrete pipe on the job with Quinn Concrete Pipe Forms. Get complete information on prices and special construction features of Quinn Forms. Give us size of job for estimate on your pipe form needs.

HEAVY DUTY

Built for more years of service—size for any diameter pipe from 12 to 84 inches—any length—tongue and groove or bell end.

Also manufacturers of concrete pipe machines for making pipe by machine process.

MEDIUM DUTY

Makes same size pipe as "Heavy Duty" but built to meet demand for lower cost equipment to produce uniform quality in smaller amounts.

QUINN WIRE & IRON WORKS [621] 12 St. Boone, Iowa

When writing, we will appreciate your mentioning PUBLIC WORKS.

5 Reasons

WHY SO MANY ENGINEERS USE

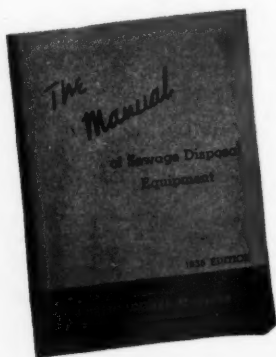
The Manual of Sewage Disposal Equipment

- ① It saves time when working up data on sewage treatment.
- ② It is a great help when explaining the various types of equipment to non-technical officials.
- ③ It is handy to use in office discussions concerning the type of equipment to be selected for sewage treatment.
- ④ It contains the names of the leading manufacturers of all types of sewage disposal equipment.
- ⑤ It is valuable as a textbook for junior engineers and students of sanitary engineering.

There is no other book like the Manual. It treats sewage disposal from the engineer's point of view. First it discusses, briefly, the results to be achieved. Then it describes and illustrates all the different types of equipment and materials which can be used by the engineer to accomplish the desired results, and names the firms from which they can be obtained.

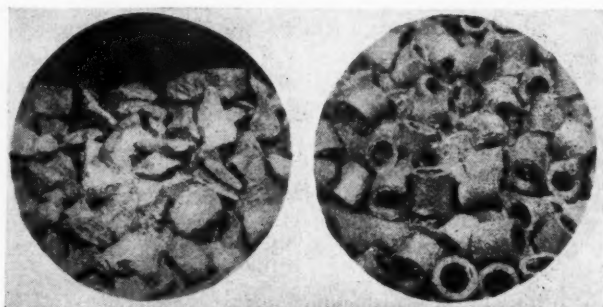
One prominent sanitary engineer writes, "To me this Manual is almost indispensable and it is a real help to have a copy on my desk at all times." Another declares, "The Manual fills a long needed want in our office since it contains in one compact volume the very information we need." And our files contain hundreds of letters voicing similar testimonials to the value of the Manual of Sewage Disposal Equipment.

In the three years since the first edition was issued, the Manual has become generally recognized as the *standard source of information* concerning sewage disposal equipment. It is used by over 4,000 city engineers, consulting engineers and other sanitary engineers. If you do not already have a copy of the 1935 edition of this valuable book, let us tell you how you can obtain one. Write the Book Dept., PUBLIC WORKS Magazine, 310 East 45th St., New York, N. Y.



★ ★ ★ ★ ★
THE STANDARD SOURCE OF INFORMATION

proper lubrication, it is good economy to limit piston speed to less than 1,000 ft. per minute. Manufacturers generally believe that if the gas contains less than 0.1% by volume of hydrogen sulphide, there is no ill effect to the engine except more rapid destruction of spark plugs and more frequent fouling of the magneto. The gas is easily and cheaply purified by passing it through a box filled with iron oxide.^{H44}



Granite

Sewage Works Journal
1 1/2 inch Raschig rings

Aggregates used by Iowa Engineering Experiment Station.

Sprinkling filters using granite and burnt clay rings were tested at the Iowa Engineering Experiment Station, as described in the November "Digestion Tank." The above illustration was intended to accompany that description but was omitted by mistake.

Sludge digestion tank at Canajoharie, N. Y., is made of steel throughout with a capacity of 3,750 cu. ft. and placed inside a building, the minimum temperature of which has been 40° as compared to -10° outside. This reduced heat loss, but there was a floating cover and a slight leakage of gas between this and the tank which was objectionable. A top jetter and jetter pump supplied with hot supernatant liquor kept floating sludge from accumulating. Water for heating coils is supplied from adjacent refuse incinerator, and sludge gas used in incinerator occasionally (as for starting fire) or in hot water boiler; amount of gas about 0.7 cu. ft. per capita per day. In similar plant at Herkimer, gas storage and a gas compressor is used, for the periodical use in the incinerator is at a rate several times that of gas production; storage obtained by adding a 5 ft. skirt around the Downes floating cover.^{C49}

Incinerator details at the Canajoharie plant, where sludge gas from adjacent sewage treatment plant is available: Multiple hearth type with coils in combustion chamber for heating water. Gas flame difficult to maintain with ordinary burner because methane is "slow burning," and flame often extinguished while charging the grate; therefore, special burners used, which can be regulated carefully for air and gas mixtures, with gas under pressure of 4 lb. Gas used to boost initial starting temperature, and any time the temperature should drop; also a burner in the combustion chamber used intermittently to insure complete combustion of waste gases.

Air-dried digested sludge cake is burned with municipal refuse in incinerator without difficulty.

Air intake should draw through ducts and not directly from stoking room. At Herkimer, ducts can take air from the stoking room near the ceiling, or from charging room through a closed duct to the ash pit. Forced draft available but seldom used.^{C49}

Incinerating refuse and sewage treatment are performed in a combined plant at Dover, Del., which is within 300 ft. of dwellings and 1,000 ft. of the new state legislative buildings. The incinerator burns city refuse and sewage screenings. The sewage plant is to serve 7,000 people at 100 gpd plus 150,000 in 8 hrs. of industrial waste and 5,000 gpd per mile of sewer of infiltration. Treatment is confined to sedimentation and chlorination. Sludge is digested and dried in glass-covered beds. Digester is heated by sludge gas. The sewage is pumped by variable-capacity non-clogging centrifugal pumps, the speed of the motors being controlled by depths of sewage in suction well. The Morse-Boulger incinerator has a rated capacity of 20 tons of garbage and rubbish in 24 hrs.^{H43}

Ground garbage will be permitted in sewers in Los Angeles, provided "at least 40% shall pass a No. 8 U. S. Standard sieve; at least 5% shall pass a No. 3 U. S. Standard sieve; at least 100% shall pass a 1/2 inch screen. Percentages are based on wet drained weights." It is hoped that finer grinding will ultimately be possible. Ground garbage tested in Imhoff cones settled only 0.5% in one hour as compared to 0.45% to 2.0% of normal sewage at the disposal plant.^{H50}

Bibliography of Recent Sewerage Literature

c, indicates construction article; n, note or short article; p, paper before a society (complete or abstract); t, technical article

- D**
The Surveyor
October 16
45. p. Sludge Digestion at Sittingbourne. By M. W. Lashmar, pp. 435-436.
46. Pumping With Sludge Gas. By I. C. Forbes, pp. 437-438.
October 23
47. Stoke-on-Trent New Sewage Purification Works, pp. 461-463.
48. Sludge Digestion: Discussion of D45, pp. 469-470.
October 30
49. West Middlesex Main Drainage Works, pp. 493-500.
50. Measurement of Sewage, pp. 515-517.
E
November 6
51. p. Treatment of Diluted Sewage by Bio-Aeration in the Presence of Nitric and Nitrous Nitrogen. By J. H. Kershaw and J. W. Finch, pp. 533-534.
Engineering News-Record
November 5
26. Industrial Waste Pollution Surveyed, pp. 636-637.
November 12
27. Secondary Treatment of Sewage in an Artificial Lake. By F. E. Giesecke and P. J. A. Zeller, pp. 674-677.
G
Water Works & Sewerage
October
30. Experiences With Gas Engine Operation. By W. B. Walraven, pp. 370-373.
H
Municipal Sanitation
November
43. Dover, Del., Combines Sewage Plant and Refuse Incinerator. By F. S. Friel, pp. 378-381.
44. Selection and Care of Gas Engines. By W. B. Walraven, pp. 382-386.
45. Aurora Sanitary District Installing Gas Engines, p. 386.
46. Sulphur Base Cements Protect Sewage Works. By C. R. Payne, pp. 387-389.
47. Cold Weather Sludge Gas Production. By H. W. Taylor, pp. 390-392.
48. Laboratory Control of Sewage Treatment. By F. W. Gilcreas, pp. 393-394.
49. Sewage and Industrial Wastes Disposal in Rhode Island. By W. J. Shea, pp. 395-396.
50. n. Los Angeles Legalizes Disposal of Ground Wastes Into Sewer Systems. By L. Aldrich, p. 381.
J
American City
November
11. Primary Treatment of Sewage and Food Products Wastes. By T. R. Kendall, pp. 53-55.
12. Mechanical Type Activated Sludge Plant for Sewage and Dairy Products Wastes, pp. 59, 61, 63.
M
Canadian Engineer
October 27
11. North Toronto Sewage Disposal Plant, p. 12.
November 10
12. p. Sewage Disposal Practices in Michigan. By E. D. Rich, pp. 8-11.
P
Public Works
November
33. n. Acid-Proof Brick Sewer Construction, p. 12.
34. Jacking 54-Inch Concrete Pipe 79 Feet Under Railway Tracks. By L. W. Monroe, pp. 16-18.
35. Large Sewer Construction by WPA. By W. B. Schmuhl, p. 23.
36. Inverted Siphon Installation at Appleton, Wis. By F. E. Fulmer, pp. 26-28.

METER BOX COVERS

Ford meter box covers for water meter settings are made in single and double lid types and in many sizes. Write for complete catalog describing covers and other equipment for water meters.

THE FORD METER BOX CO.
WABASH, INDIANA, U. S. A.



SETTING AND TESTING EQUIPMENT FOR WATER METERS

Water Filters and Filtration Plant Equipment

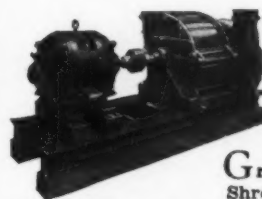
for Domestic and Industrial Service

SWIMMING POOL FILTERS AND RECIRCULATING PLANTS

EQUIPMENT FOR SEWAGE TREATMENT PLANTS AND PUMPING STATIONS

We serve as skilled contractors to furnish and install the complete equipment, piping, etc., in all forms of water and sewage plants.

ROBERTS FILTER MFG. COMPANY
640 COLUMBIA AVE. DARBY, PENNA.



SEWAGE SCREENING SHREDDERS

Gruendler Ball Bearing Sewage Shredders handle all screenings efficiently and uniformly, eliminating trouble at ball valves. Manufactured in sizes to meet any capacity. • Also manufacture Garbage Shredders in connection with disposal through sewers, aerating systems and incinerators and where garbage is used as part of the fuel.

Write for full particulars

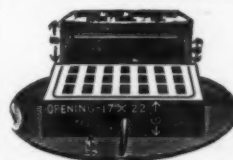
GRUENDLER CRUSHER & PULVERIZER CO.
2915 N. MARKET ST., ST. LOUIS, MO.

How to Design and Build SMALL EARTH DAMS

Send 30c in stamps or coin for this handy 24 page illustrated booklet on earth dam construction. Covers: Primary Factors in the Design and Construction; Spillway Capacity and Runoff Estimates; Materials for Construction; Construction Procedure. The booklet is a reprint, in handy pocket size, of articles published in PUBLIC WORKS within the last 13 months. Book Dept., PUBLIC WORKS, 310 E. 45th St., New York, N. Y.

STREET, SEWER AND WATER CASTINGS

Made from wear-resisting chilled iron in various styles, sizes and weights



MANHOLE COVERS, WATER METER COVERS, ADJUSTABLE CURB INLETS, GUTTER CROSSING PLATES, VALVE AND LAMP HOLE COVERS

Write for Catalog and Prices

SOUTH BEND FOUNDRY CO.
Gray Iron and Semi-Steel Castings
SOUTH BEND, IND.

When writing, we will appreciate your mentioning PUBLIC WORKS.

Highway Design and Construction Notes

Rhode Island State Highway Curb Design

A sloped-face curb section, having a vertical face for a height of one inch above the pavement and then sloping outward on an angle of 45 degrees for a height of 6 inches, with a flat top of 4 inches has been adopted in Rhode Island for the following reasons:—(1) Recent traffic surveys show a tendency of the motorist to ride with an unnecessarily wide margin of safety between his vehicle and a vertical face curb, causing overlap and thus decreasing the efficiency of the inside or opposite lane. It is hoped that the sloped face which has the appearance of being in a horizontal plane will eliminate this psychological effect and correct the second lane encroachment; and (2) in case the motorist is forced off the pavement the sloped face curb will offer very little resistance to deflect his line of travel. The use of slope faced curb against sidewalk areas should

be restricted to sparsely settled suburban or rural areas as they afford very little or no protection to the sidewalk pedestrian in the case of a motorist who loses control of his automobile.

The integral section of concrete curb will be constructed simultaneously with the concrete pavement, and to insure bond the construction interval has been restricted to forty-five minutes. This section may be constructed with either a vertical or sloped face and should show a saving in construction cost.

Operation Data on Concrete Pavement Breaking

The Finn Equipment Company of Cincinnati, Ohio, which has 3 Novo pavement breakers in operation and has broken over 200,000 square yards of concrete under a wide variation in conditions and requirements on practically all types of work in West Virginia, Kentucky, Indiana, Michigan and Ohio, reports on operation data as follows:

Price is usually given on the square yard basis. This ranges from 7c to 20c per square yard, depending, of course, on the kind of concrete to be broken, the size of job, etc. Some states specify that concrete shall be broken into 6" pieces. This, on a standard 9-7-9 highway, carries a price of around 9c to 10c per square yard for recently laid concrete. Other states specify man-size pieces; this means breaking so that nothing is over 18" to 24" long. Still other states do not specify size, which means they can use almost any size that can go through the dipper.

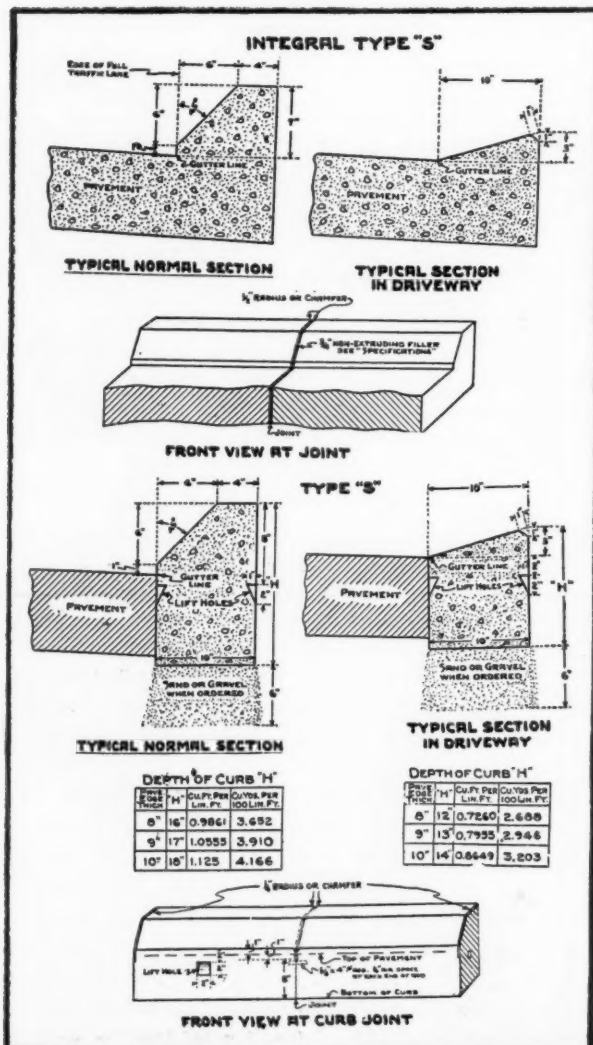
The simplest jobs are concrete roads, the thickness of which makes very little difference as far as making time is concerned. For example, an 8" or 9" pavement broken in pieces to be handled nicely with a one-yard shovel can be broken at the rate of 750 to 1,500 square yards per day. On this type of work the price is around 7½c per yard. Reinforced concrete with either steel rods or mesh do not change these figures a great deal. Generally speaking, these figures can be used where concrete is to be wasted.

One job now in progress consists of 3" of asphalt on a 6" concrete base with header curb on the side. The difficulty involved here in breaking a 9" thick pavement to 6" size specifications can readily be seen, but such conditions have been met.

Bridge floors up to 27" thickness of reinforced concrete have been successfully broken. On a bridge demolishing job where the structure was none to strong to withstand heavy shocks, 18" concrete was broken by dropping the hammer only 3'. This broke the concrete and cracked it loose from the reinforced steel.

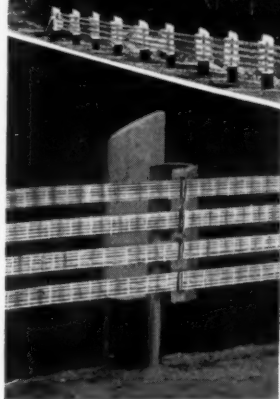
Last winter at Flint, Michigan, Hamer Brothers encountered a breaking job of comparatively new 10" reinforced concrete on top of ground which was frozen to 3 to 4 feet below the pavement. This work was done for 14c per square yard by The Finn Equipment Co.

The ability of the breaker operator is an important



New curb section used by R. I. State Highway Department.

PAGE *traffic* TAPE



• Motorists favor Traffic Tape because these resilient bands of steel wire stop cars with a cushioning action. This action not only protects the life of the motorist but assures less damage to his car.

PAGE Traffic Tape is as flexible in application as it is in resistance to impact. . .

Here—in this illustration—four strong, tough, flexible bands of Traffic Tape guard the motorist from the hazards of the deep gorge that parallels the highway. . . Where the hazards and the traffic are less, ample protection is provided by three or in some cases only two strands. . . It is this flexibility of application, plus the low cost of erection and maintenance, which appeals alike to taxpayers, highway engineers and contractors. Samples will be sent upon request.

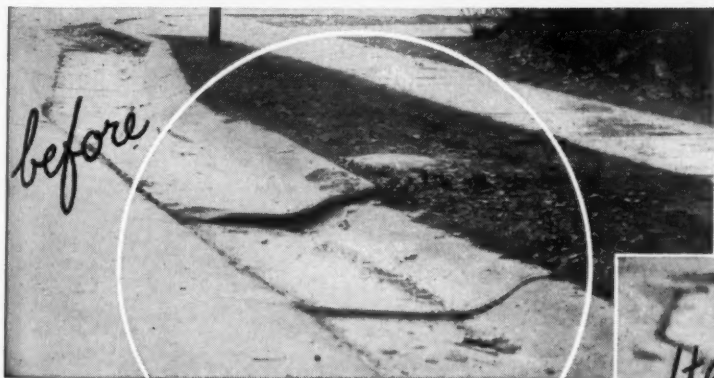
PAGE STEEL & WIRE DIVISION OF THE AMERICAN CHAIN COMPANY, INC., MONESSEN, PENNSYLVANIA

District Offices: New York, Pittsburgh, Atlanta, Chicago, San Francisco

In Business for Your Safety

MUD-JACK METHOD

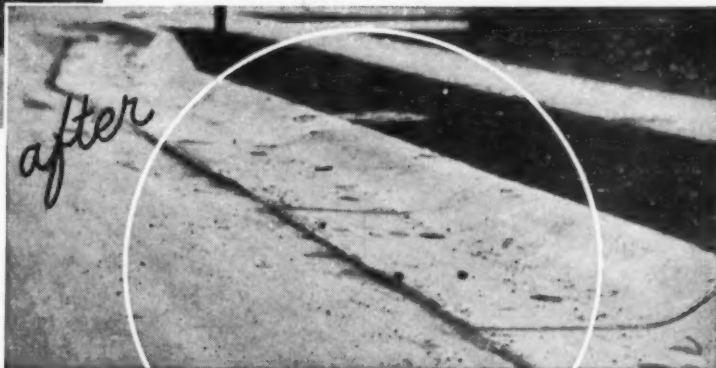
for raising concrete curb·gutter·walks·street



Sunken Curb and Gutter
Marked for Reconstruction

but

THE MUD-JACK METHOD
corrected the settlement and
saved the reconstruction costs



Save CURB—GUTTER
WALKS—STREETS

The Mud-Jack method saves the slab—corrects the subgrade—eliminates pedestrian hazards. Write for data to reduce maintenance expense.

KOEHRING

Pavers · Mixers · Shovels · Cranes
3026 WEST CONCORDIA AVE.



COMPANY

Draglines · Dumpsters · Mud-Jacks
MILWAUKEE, WISCONSIN

For Special information, consult the classified Readers' Service Dept.—pages 51-53.

factor. There is a lot of difference in the yardages that two men will get from the same outfit. One operator will be able to get six to seven blows a minute, while another on the same machine will not be able to get more than four or five. This, of course, cuts the yardage broken considerably.

With reference to the damage of underground water or gas mains, there was one job on which the Novo pavement breaker worked where practically all the gas lines were thin steel pipe. A strip of concrete was broken over a 36" high-pressure steel main. The concrete was reenforced every 6" both ways with 1/2" steel rods; this pavement had been laid only one year previous. With less than a 3' cover over this high-pressure main, the breaking was done without any damage whatsoever to the pipe line. Of course, it takes a skilled operator to produce this kind of work.

German Soil Research in Road Construction

A thorough investigation of soil and subgrade conditions now forms part of the routine of German motor road construction. It is emphasized that such investigation should take place at a sufficiently early stage to influence, if necessary, the choice of alignment.

The following recommendations are made regarding foundations, earthworks, and drainage:—(1) The choice of surfacing must depend largely on the nature of the subgrade; surfacings of the "flexible" type should be constructed on stable subgrades only. Concrete surfacings have given satisfactory service on unstable subgrades, but adequately dowelled joints must be provided. (2) Concrete foundations are recommended on subgrades which are liable to frost damage. Foundations of stone pitching require special protective measures; surface repairs effect no permanent improvement when such foundations have become displaced either in the later stages of construction, under traffic, or by frost. (3) In soils where the proportion of particles of less than 0.02 mm. diameter does not exceed 3 per cent., frost damage does not take place. If the particle size is very uniform, the safe proportion of such particles may be as high as 10 per cent.

(4) Measures of protection against frost include the

provision of a layer of porous material (gravel, sand, brushwood), or of a bituminous insulating layer. (5) All types of soil, with the exception of soils containing a high proportion of organic matter (e.g., peat), can be successfully used in the construction of embankments. The consolidation of plastic soils, however, must not be undertaken in wet weather, as tamping then increases the plasticity of the material by incorporating a further quantity of water. (6) Tamping or vibration is preferable to inundation methods, though these may be successfully combined with either of the former.

(7) In cases where a considerable proportion of plastic material must be used, greater stability is obtained by placing and thoroughly consolidating alternate layers of plastic and porous soil than by covering a core of plastic material with porous soil. The stabilization of such a core is exceedingly gradual, and there is constant liability to spread or subside. (8) The mixture of clay or loam with sand or gravel is not successful in practice, as a comparatively small amount of clay dangerously increases the plasticity of the mixture.

(9) Careful and uniform consolidation is of first importance. The depth of soil to be placed and consolidated at a time should in no case exceed 40 in.; the usual maximum is 30 in. In the case of backfills in the construction of abutments the soil should be placed and consolidated with light machinery in layers not exceeding 8 in. thick, in order to avoid damage to the adjacent structures. The provision of a dry masonry course behind wing walls of abutments is actually injurious, as the soil of the fill becomes forced into the interstices of the stone and thus permits subsidence. (10) The generally accepted limiting slope for embankments (1:1 1/2) and excavations (1:2) is too steep for plastic soils.

(11) Drainage courses constructed on the face of embanked or excavated slopes assist surface drainage only; they are without influence on the shear resistance of the interior, and hence cannot prevent spreading. (12) Side ditches are usually superfluous except where they are required for the drainage of adjacent land; in most cases they suffice for the removal of surface water only, and this can be more economically effected by means of channels or percolation courses. The latter, which must be of sufficient depth, afford the best means of eliminating ground water or the interior drainage of embanked or excavated slopes. (13) The culverts, etc., should be

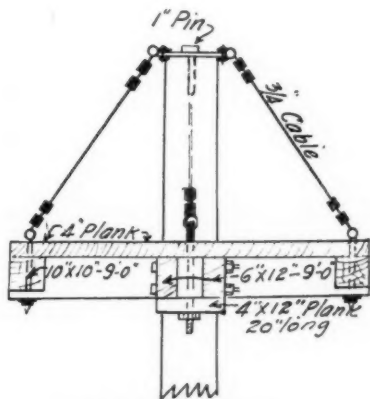
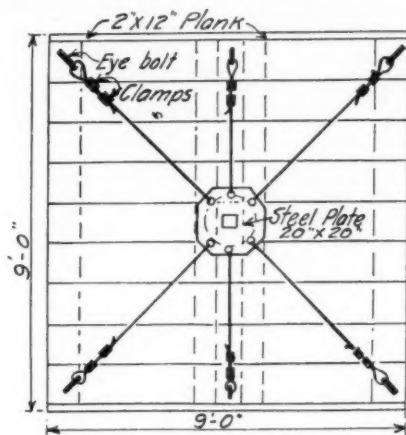


Waupaca Co., Wisc., Charles Larson, highway commissioner, uses this FWD gasoline tank truck to service its 60 pieces of equipment operated in road building and maintenance, snow removal, etc. The county uses about 270,000 gallons of gas a year, and this unit saves money over the older system of distribution in 5-gallon cans. Looks like a good idea for other counties.

laid in a course of porous material which widens considerably towards the upper surface; this procedure eliminates the irregular incidence of frost action above the culvert, and hence minimizes possible injury to the surfacing during frost. (14) Blasting is the most economical method of removing peat strata of considerable depth.—*Road abstracts: L. CASAGRANDE: Strassenbau.*

Testing Bearing Capacity of Piles

It becomes desirable, in designing many kinds of structures—buildings, treatment plants, sewers, etc.—to provide pile foundations for same; and to know what safe load can be assigned to a pile driver in the soil in question. While estimates can be made, the only real information is obtained by actually driving a pile on the site and loading it.

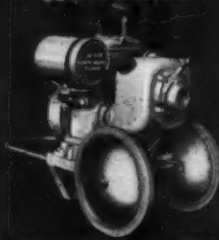


Plan and elevation of test loading platform

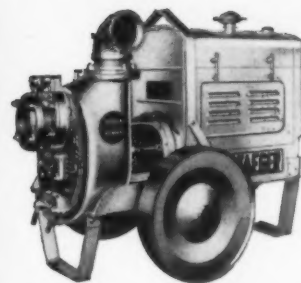
For applying the load, a convenient platform was designed by George V. Walsh, project manager for the PWA in connection with the Westfield Acres housing project in Camden, N. J. The construction of the loading platform is shown by the accompanying plan and elevation. Cast iron pigs were used for loading and 90,000 lbs. was placed on the platform. One pile was driven by a No. 1 vulcan single-acting steam hammer until the penetration of the last six blows totaled only $2\frac{1}{2}$ in., which theoretically gave a bearing power of 30 tons. When 15 tons was placed on the platform the top of the pile settled 0.01 foot in 24 hrs. When an additional 15 tons had been on for 24 hrs. it had settled 0.003 foot more; and with 45 tons on for 24 hrs. it settled an additional 0.008 foot, or a total of 0.021 foot, or $\frac{1}{4}$ inch.

LOWEST PRICE

7,000 GALLON
JAEGER "HANDY"
SELF-PRIMER



COMPACT, PORTABLE



JAEGER "SURE PRIME" PUMPS

Prime faster, pump full volume, pump more hours. Sizes 2", 3", 4", 6", 8", 10", capacities to 200,000 G.P.H. Send for catalog. The Jaeger Machine Co., 400 Dublin Ave., Columbus, O.

CONCRETE VIBRATORS

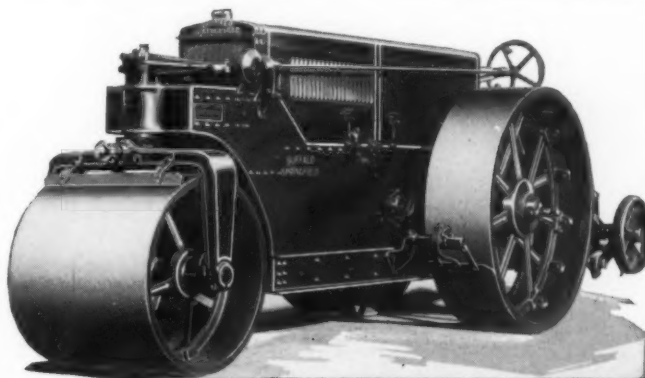
Air operated vibrators for all classes of concrete construction including bridge deck slabs, dams and locks.

Portable Vibrating Screed Boards for highway pavements.

Special steam operated vibrators for placing hot asphalt mixtures.

Write for circulars and engineering data.

MUNSELL CONCRETE VIBRATORS
RENTALS 995 Westside Ave., Jersey City, N. J. SALES



ESSENTIALS

● Long life and low operating costs should be considered above all other features in the selection of a road roller. Buffalo-Springfield's ability and reputation for furnishing these essential qualities have remained unchallenged for forty-five years.

**THE BUFFALO-SPRINGFIELD
ROLLER CO.**

SPRINGFIELD, OHIO

When writing, we will appreciate your mentioning PUBLIC WORKS.

Malaria Control in Impounded Water

From a report by the National Malaria Committee, in cooperation with the U. S.
Public Health Service

MOSQUITO control should be considered in the design, construction, and operation of any dams that create artificial ponds or lakes in sections where malaria exists or may be introduced. In building a dam and making an artificial pond, regardless of size, ideal breeding places may be created for the species of mosquitoes that transmit malaria. Provisions for malaria control during the construction and maintenance of impounded waters should be under governmental regulation.

In treatment of the subject, the term "impounded waters" refers to artificial bodies of water, large or small, with wholly or partly obstructed flow due to construction of dams. The words "ponds and lakes" will refer not to impounded areas but to natural bodies of water.

If it were not for impounded waters, ponds, swamps, and lakes, malaria would probably be a minor health problem in the United States, since such waters afford preferential breeding places for *Anopheles quadrimaculatus*, the principal or probably the sole natural carrier of malaria in the Southeastern United States. However, the mere impounding of the water is not the only factor. Aquatic and semi-aquatic vegetation which pierce the water surface, dead vegetation, bark, and trash flottage on the water surface furnish the ideal breeding conditions for *Anopheles*.

The first studies of the influence of impounded waters upon malaria incidence were undertaken by Dr. H. R. Carter and his associates in 1913, on the pond at Blewett's Falls, N. C., at Lock 12 on the Coosa River, and Lock 17 on the Warrior River in Alabama. Following the construction of a hydro-electric plant in Alabama, a great number of suits were filed against the company by nearby residents, claiming infection with malaria as a result of the creation of the lake. The court testimony showed that little was known of the problem at that time, but from 1914 to 1925 studies were made by the Public Health Service of a number of reservoirs in several states which formed the basis for all present state regulations governing impoundage of water. Regulations were offered as early as 1915, and in 1921 Dr. T. H. D. Griffiths of the U. S. Public Health Service drafted suggested regulations for the Federal Power Commission. The first state regulations were adopted by Alabama and Virginia in 1922. The Alabama regulations were declared illegal on a technicality, but were reenacted in proper form in 1927.

Conditions Favoring Mosquito Production

The regulations are based upon eliminating, or making possible the control of, conditions favorable to the production of *Anopheles*. These must be considered in the design and construction as well as in the operation of dams and reservoirs. Conditions favorable to *Anopheles* production are constant water level, collections of fine flottage or other debris, and aquatic or semi-aquatic vegetation which offer protection to the larvae, minimum wave action, and absence of natural enemies of mosquito larvae. The breeding occurs in shallow water along the shore, especially in the upper ends of inlets or tributaries of the reservoir, and is most exten-

sive during the early years before a biological balance is established.

Proper preparation of the basin is fundamental, and includes (1) clearing to provide a clean water surface and clean shore line, (2) draining areas which would retain water with fluctuations of the reservoir, (3) provision for stocking with top-feeding minnows. The regulations governing the maintenance of a project following impoundage are directed primarily at biological control, which is not always practical, and must be supplemented by the use of larvicides.

The design of the dam must be such as to provide for adequate fluctuation of the water level, seasonal and periodic. By seasonal fluctuation is meant the maintaining of the water at the maximum normal level during the winter and spring, and lowering it to normal level at the beginning of the mosquito breeding season. This inhibits the growth of vegetation, and when the water is lowered flottage will be stranded, with a resulting relatively clean shore line. Periodic fluctuation is the lowering of the water below the normal level at weekly or ten day intervals during the mosquito breeding season—June, July, August and September, and in some years, May and October. This fluctuation tends to discourage rank growth of aquatic vegetation. *Anopheles* larvae are stranded and die or are carried into open water where they may be destroyed by their natural enemies. With fluctuation, larvicidal measures are reduced, and in some cases may even be eliminated with consequent reduced costs. Without fluctuation, control by larvicides will be extremely expensive or even impossible. In storage reservoirs from which water is generally drawn during the dry summer months, the gradual drawdown serves much the same purpose as the periodic lowering and raising.

The construction schedule must be so planned that water is not impounded during the mosquito breeding months, for with the water rising slowly through uncleared areas, excessive production will result in spite of strenuous larvicidal measures, as was experienced on Lake Martin and Lake Wilson in Alabama. The optimum time of impounding is in the fall or winter so that there will be time for flottage to sink or to collect and become stranded on the shore.

Clearing the Area

In clearing the area to be inundated so that effective mosquito control can be maintained, it is necessary to remove all trees, undergrowth, logs, etc., which may create or collect flottage between the maximum and minimum pool levels, to cut all trees and brush that would penetrate the surface and collect flottage at low water, and to remove vegetation along the shore line.

In the area between the high and low water shore lines, the material is generally burned except for timber salvaged as lumber or fire wood. The same procedure is used in the shallow areas below the low water shore line, but in deeper parts of the reservoir the trees which would penetrate the low water surface are often felled and wired down to stumps. This is a less expensive operation, but unless well done may cause trouble by the trees breaking loose and floating to the surface, creating

drift and flottage which interferes with malaria control operations, and also presents a hazard to navigation and to the operations of hydro-electric plants. Additional clearing and brushing is necessary beyond the high water shore line in order to provide as clear a shore as possible.

Fluctuation in water level alone is not always sufficient to control *Anopheles* production. Screening of homes within flight range (at least one mile) of the impounded body of water should be standard procedure—in fact the average standard of living of the American people today requires a screened home for every family, so this cannot be termed an extra measure of precaution on impounded waters. Applications of larvicide to supplement proper impounding procedure, wherever and whenever necessary, has been adopted by hydro-electric companies on the recommendations of health authorities.

Control by Larvicides

There are two generally accepted larvicides, namely: various mixtures of oil, consisting chiefly of petroleum products, and Paris green "dust." Oil was first used and still has a wider application because of its toxicity to a greater variety of mosquito larvae. The equipment for applying larvicide on impounded waters has had progressive development since the work was first undertaken more than a decade ago.

Oil was first applied through various hand operated spray pumps mounted on boats paddled by hand or powered by inboard motors. Then pneumatic spray tanks came into use operating with compressed air, first used from paddled boats, and later from boats with outboard motors which enabled the operators to maneuver their way in and out of the most difficult places with ease.

The next development was the "water oil" method of applying oil which has had wide adoption on the larger projects. In this method oil is carried from boat to object by a water stream. A small motor driven centrifugal pump taking suction from the lake provides the water stream. Oil from the storage tanks is introduced into the suction of the pump through a small pipe. A valve on this line enables the operator to vary the amount of oil discharged at will. Initially the boats carrying this equipment were powered by outboard motors, though recently inboard motor driven units have been provided. The one inboard motor serves to operate the pump as well as propel the boat.

The oil and water stream of the "water-oil" unit can be made to carry 60 to 100 feet which is a farther distance than that of the pneumatic oil sprayers. The stream will also carry well in the face of a breeze. The force of the stream can be employed to break up accumulated flottage and carry through heavy vegetation to protected breeding places. The range tends to keep the boat in deeper water and reduce damage to the propeller shaft.

Several years ago the use of Paris green was given new impetus and came in for some application on impounded water. In this work it has been applied by both power and hand driven dusters mounted in paddle or motor driven boats. Various inert diluents and mixtures of Paris green have been used. A popular one is 5% Paris green to 95% hydrated lime by volume. The Paris green must be of a good grade containing at least 50% arsenious oxide and of known toxicity for larvae. The rate of application is from $\frac{2}{3}$ to 1 pound of Paris green per acre.

Occasionally areas are found on lakes where the use of hand spraying or dusting equipment is necessary. Equipment most commonly used are the knapsack and pneumatic sprayers and hand dusters. While larvicides



**JAEGER SPEED
KING - 75 and 105
TRAILER
MIXERS**

Trail at 35 m.p.h. on Timkens and pneumatic tires—5 to 7 seconds loading, 7 second discharge of stickiest dry concrete. End discharge cuts placing costs, pours direct into forms. Get our prices, all sizes 3½ S to 56S, latest type Tilting and Non-Tilt mixers.

THE JAEGER MACHINE COMPANY
400 Dublin Avenue Columbus, Ohio

Hotstuf
TRADE MARK

Contractors Equipment
ASPHALT HEATERS . . . SURFACE HEATERS
PAVING TOOL HEATERS AND TOOLS
HI-SPEED TRAILER TOOL BOXES
Distributors in Principal Cities
MOHAWK ASPHALT HEATER CO.
FRANKFORT NEW YORK

★ Enjoyable ★
★ FACILITIES for ★
★ BUSINESS ★
★ ENTERTAINING ★



★ THE ★
★ Bubble ★
★ ROOM ★
★ DINNER or LATE SUPPER ★

Many a big contract is born in our "Bubble Room." Here famous bands croon away your cares as top talent brings down the house. Come to the center of Baltimore. Three restaurants. 700 rooms, each with bath and shower. \$3 to \$8 single.

Baltimore St. at Hanover, Baltimore, Md.

**LORD BALTIMORE
HOTEL**

When writing, we will appreciate your mentioning PUBLIC WORKS.

will continue to be used, the present tendency is to limit this temporary work and spend available money on cleaning regrowth from the shore line, for more lasting effects.

After water has been impounded it is the practice to keep the lake under careful observation by making periodic inspections for larvae and adult mosquitoes. A trained and experienced field man is necessary. He is usually provided by the company and cooperates with health officials, submitting weekly reports covering the results of observations and control operations.

In making inspections, the extent of mosquito breeding is determined by dipping along the shore line among vegetation and flottage, and recording the number and stage of development of the mosquito larvae. Inspections are also made for adult *Anopheles* to check the effectiveness of the control work. The malaria-carrying mosquito rests during the day time, preferably in a dark, sheltered spot. Mosquito catching stations are established at intervals around the reservoir—residences, barns, under-side of bridges, etc.—which are examined at regular periods with the aid of a flashlight, and the mosquitoes caught are identified.

For intelligent planning and operation of malaria control measures, it is essential to know the distribution of population, together with the prevalence and distribution of malaria in the area affected so that work can be intensified in the more important areas or efforts reduced where the problem is less acute. It is also important to determine the malaria incidence before and from time to time after impoundage so that the effect of impoundage and effectiveness of control can be measured. The population affected is that living within one mile of the reservoir, the approximate flight range of the malaria-carrying mosquito.

The completion of major hydro-electric projects often requires many months or perhaps several years for completion. During the construction period hundreds of workmen, as well as many of their families, must be housed in semi-permanent or temporary camps. Living environments must be pleasant and health conditions maintained above the possibility of any serious disease outbreak. The medical staff in charge must be active indeed to safeguard the lives and health of these people.

Workmen will be drawn from many sources and some may come from malarious areas. There is also the probability that infected persons may enter the camps at any time. Prevention measures in the groups are therefore important. Control of mosquitoes in and about semi-permanent camps in the summer is feasible through ditching and larvicidal operations. These primary measures may not be feasible in protecting the workmen housed in temporary camps. In such cases resort must be made to the less protecting so-called "secondary measures" of screening, use of bed nets, insecticides, etc.

It is now the general policy of hydro-electric companies in the South to spare no effort toward preventing the introduction and spread of malaria on and about their projects. A careful check is kept on the inhabitants, particularly new arrivals, and where the disease is found, prompt corrective measures are used. This is done not alone in an effort to keep construction labor in a healthy condition but to have as few possible sources of infection later when the lake is impounded.

It may be stated that there should be no conflict whatsoever between hydro-electric development and health conservation. Rather the two are workers together for the common good; water power promoting industrial and social progress, and public health providing an atmosphere in which enterprise can live and move.

Mud-Jacks Eliminate Road Dips

A recent innovation in road maintenance in Rhode Island was the introduction of a "mud jack" operation for lifting concrete road slabs back into place after they had settled due to foundation failure. Existing equipment was adapted to this new type of work and several short sections of concrete pavement were brought back to original line and grade. The "dips" in the pavement had previously been quite noticeable to motorists. An interesting feature of the work was that traffic was not disturbed and the original concrete slabs were salvaged.

An unexpected condition was encountered at Great Road near Union Village. The slab had settled not because of inferior material, but by the displacement of fine material through a culvert washout. It was easily restored, although a large volume of material was required to fill the voids existing in the embankment. These cavities were very extensive, and left practically no support for the pavement slab in the outer lane.

Best results were obtained with slabs which were not more than four inches below grade. The worst instance treated was a slab which was raised approximately nine inches. The methods followed were similar to those used on state highways in other states, except that certain modifications in procedure more adaptable to the equipment were worked out as the "mud jacking" crew gained experience.

Lubrication Plan for Canal-Digging Equipment

Lubrication efficiency and convenience played a large part in a recently completed canal-widening project at Blue Island, Illinois, where a Bucyrus-Monighan dragline was put to work taking out rock and clay for 3 miles along the canal bank. The job was handled by Morrison-Knudsen, Inc.

Well planned lubrication was a feature on this job. In the shovel cab was mounted an Alemite air operated "Rock Crusher" power gun. This had a lubricant delivery of from 12 to 18 ounces per minute at air pressures of from 150 to 200 pounds. Four outlets were used in this installation in order to simplify the lubrication of the many fittings on the machine, there being 150 fittings on the outside rollers alone. One of the inside outlets, for example, consisted of a 20-foot hose line, complete with a control valve and whip-end hose. The lubricating end of the whip-end hose was equipped with a pull-on Buttonhead coupling to permit a leak-proof seal during lubrication. The other end had a coupling and check valve.

The lubricant being maintained in the line under pressure at all times, the operator had merely to make a quick connection of the whip-end hose between the fitting to be lubricated and the fitting in the line shut-off valve, then open the valve. Thus the simple operation of the control valve gave finger-tip control for flushing all the worn grease out of the bearing and shooting fresh lubricant in.

To disconnect the hose and use it on another outlet in an installation of this sort, the line shut-off valve is closed, the pressure in the hose released, and another fitting or two given shots of the remaining lubricant.

The other outlets on the shovel installation were similarly equipped, the outside fittings being reached through a pipe that extended through the cabin wall. All the bearings were thus assured of a supply of clean grease.

Los Angeles County Sanitation Districts Ocean Outfall Sewer

By C. F. GREEVES-CARPENTER

WORK is progressing rapidly on the \$2,640,000 outfall Sewer of Los Angeles County Sanitation Districts Nos. 1, 2, 5 and 8, which include eleven incorporated cities, several unincorporated towns and surrounding territory. These communities are all inland and have no outlet to the ocean. The respective mayors and chairmen of the Board of Supervisors are directors in this project which involves a total area of 227 square miles, and a population of 450,000. This territory is served by a sewer system consisting of nearly a thousand miles of local and trunk sewers which empty into a common treatment plant. The present project provides a means of discharging the plant effluent into the ocean off White Point. It involves the construction of $6\frac{1}{4}$ miles of 8-ft. horseshoe section tunnel and 1 mile of 5-ft. discharge into the ocean. This latter line terminates in water 114 ft. deep. When the maximum capacity of this pipe is reached—about 100 cfs—another similar line will be laid paralleling it.

The present capacity of all sewers discharging into the plant is 200 cu. ft. per second. Any flow in excess of the capacity of the 8-ft. sewer and the 5-ft. ocean line will be pumped, using sludge gas as a source of power, it being more economical to do this than to provide a larger sewer.

The accompanying pictures and comment show the progress of the work, the methods used, and some details of the tunnel sections.

The contractors were as follows: On the north section of the tunnel, United Concrete Pipe Co.; on the middle and south sections, Shofner & Gordon & Himan Bros.; on the submarine pipe, Merritt, Chapman & Scott Co., with American Concrete & Steel Pipe Co., furnishing the concrete pipe and the Kinney Iron Works the cast iron joints. Other items of construction interest were

the $2\frac{1}{2}$ -yard special hopper car designed and built by Garlinghouse Bros.; the 14-cu. ft. pneumatic placer furnished by Ransome Concrete Machinery Co.; the jackhammers by Ingersoll-Rand; the compressors by Rex; the steel cradle side dump cars by Madsen Iron Works; the arch forms by the Consolidated Steel Co.; and the crane and clamshell by Northwest Engineering Co.

A. K. Warren is chief engineer and general manager of the Los Angeles County Sanitation Districts; A. M. Rawn, assistant chief engineer, and F. D. Bowlus, resident engineer.

Details of Tunneling and Lining Methods on Deep Sections

(More pictures on following page)

1. Below, left: The face of the tunnel in the north section. This section was all in sand. The ribs are 5-inch I-beams on 4-ft. centers, with 2-inch spiling. In order to encase the ribs in concrete the spiles were cut off after the rib ahead had been placed. These spiles had not been cut when the picture was taken.

2. Right, below: The tunnel in sand after the spiles had been cut off. The cutting was done by boring with an auger, because they were under so much bending tension they would cramp a saw. The face of the south section of the tunnel was in shale. At the point where the tunnel was about 500 feet below the surface the ground showed such a tendency to swell it was necessary to use 6-inch H-beams on $2\frac{1}{2}$ -ft. centers for ribs, but spiles were not necessary.

1



2



Open Cut and Tunnel Section Construction Methods on Los Angeles Ocean Outfall Sewer



③ Left: Concreting the open cut section, 960 feet long, and approximately 30 feet deep. This was excavated with a clamshell bucket without sheeting. The soil formation was sandy with sufficient clay to make it stand well on a slope of 2 on 1. This section and the tunnel have a horseshoe section 8 ft. by 8 ft. with the invert laid level, 12 feet below mean sea level. This is done to ensure the tunnel being full of water at all stages of the tide and for any flow. When the flow exceeds 85 cubic feet per second at higher high tide it will be necessary to use pumps. These pumps will be run by gas engines using the gas from the digestion tanks, which would otherwise be a waste product.

④ Below: Dumping the muck from the north section of tunnel. Open cut conduit shown in background. North end of tunnel was of same sandy formation as in open cut section. Muck was hoisted out by means of crane and clamshell bucket shown in upper right corner of the illustration. Concrete lining was not put in until the excavation was complete. In lining, the invert was poured first, beginning at the end furthest from portal and working back to it. The arch was not begun until the last section of the invert had cured for 14 days. Approximately 8,000 feet of tunnel was built from this portal.

⑤ The headworks at the shaft. The outlet of the shaft is 165 feet above the invert of the tunnel. Approximately 6,300 feet of tunnel is to be built to the north and 7,700 feet to the south from this shaft. This was mostly in shale with some sand at the north end.



Details of Procedure on the Ocean Outfall Line from the Connection with the Tunnel

6

6 The portal at the south or ocean end of the tunnel. Muck was dumped into trucks standing in a sump in front of the buildings (not shown in the photo) and hauled out. Approximately 9,000 feet of tunnel to be built from this portal.

7

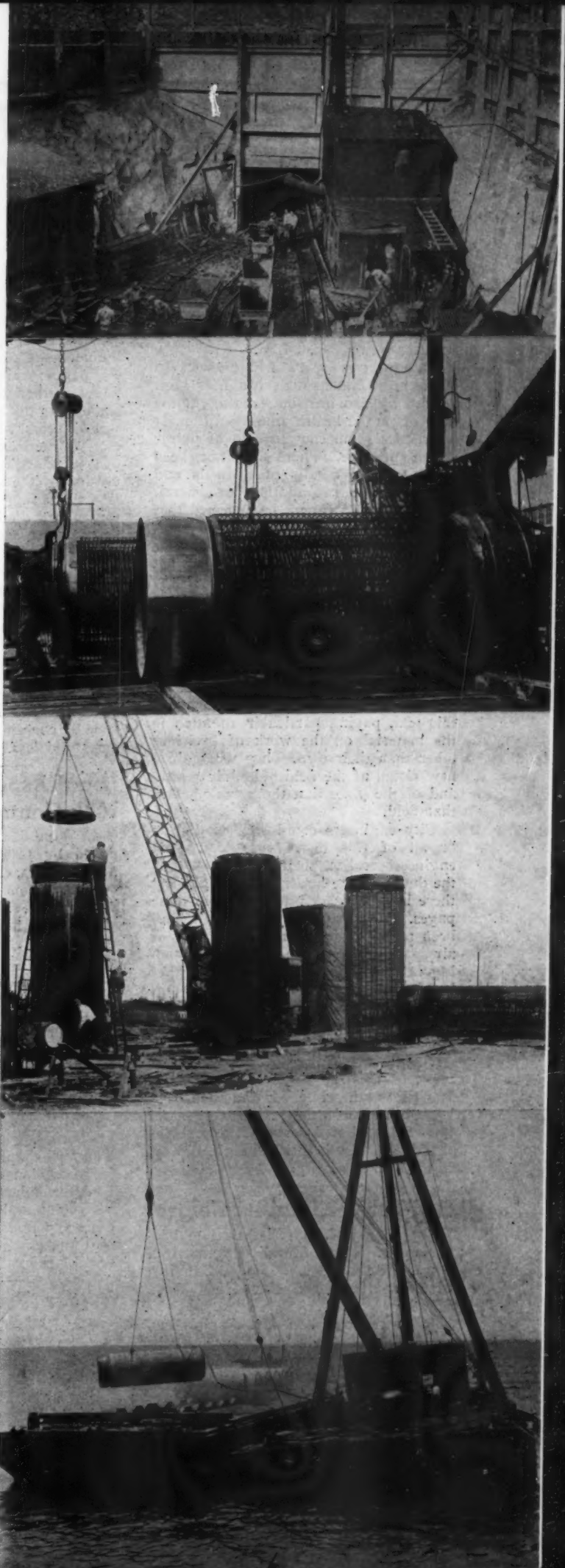
7 The reinforcing cage and Meehanite cast iron ends for the 5-ft. concrete submarine pipe. To provide flexibility many of the sections used ball joints. In places where a more rigid joint could be used, an internally-caulked type of bell and spigot tube was employed. Most of the pipe sections were 18 feet long, but some of the ball and socket sections, such as those shown, were only 12 feet long to give greater flexibility. Meehanite cast iron was used for the parts exposed to sea water because of its ability to resist corrosion, its strength, and the ease with which the longitudinal bars could be welded to it.

8

8 Casting the reinforced concrete pipe sections. Vibrators were used for tamping and the pipe was cured with steam.

9 Loading the concrete pipe on the derrick barge preparatory to laying. Where the bottom was rock a trench was first excavated and a layer of gravel was placed on the bottom. After being placed and caulked tremie concrete was poured around it, filling the trench to a point a foot above the crown of the pipe. In the deep sections where the bottom is sand, the pipe will be merely laid on the bottom, but ball joints will be used every 36 feet to insure sufficient flexibility should any of the sand be scoured out below. The pipe will extend 5,000 feet off shore to a depth of 114 feet, where a diffuser will divide the stream into three parts. The great depth with the multiple outlets should not permit any pollution on shore. When the flow increases to about 100 cubic feet per second a second 5-ft. pipe will be laid, paralleling the first.

9



BOOK REVIEWS

Sedgewick's Principles of Sanitary Science and Public Health

Rewritten and enlarged by Samuel C. Prescott and Murray P. Horwood of the Massachusetts Institute of Technology. 613 pages. No illustrations. The Macmillan Co., New York. \$4.25.

First written by Prof. Sedgewick in 1901, this famous text has now been revised by two men outstanding in the field of public health administration. It is practically an encyclopedia of public health practice. There has not been space to give details of methods and practices; the information is general. For instance, it cannot be expected that within the space of 18 pages information can be given of value to the water plant designer and operator. Such is not the purpose of the book.

In too many of our health departments there is a lack of understanding, between the different bureaus or divisions, of the relative place that the work of each should have. Let us suggest to health workers, whether engineers, doctors, nurses or milk specialists, that they read this text, paying particular attention to the material on the work of divisions other than their own. They will gain a new vision of the field of public health, and of the place that their work has in that field.

City engineers could well read most or all of this text. More than most engineers realize, their duties touch on the duties of the health department. But there is little exact information in these pages. How many city engineers have been asked what the minimum floor or air space per capita should be for rooming houses, or for institutions or other buildings? And how many know? This same lack of exact information on "how to do it" is in evidence throughout the whole book.

A careful reading of the whole, or most, of the 613 closely printed pages is well worth while for the sake of a broadening of the readers general knowledge, but he should appreciate that it will not help him much, if any, in his own speciality.

Soil Erosion and Its Control

By Quincy C. Ayres, Associate Professor of Agricultural Engineering, Iowa State College. 365 pp., 235 ills. McGraw-Hill Book Co., New York. \$3.50.

With apologies to Mr. Longfellow, some anonymous rhymester has written: Hordes of gullies now remind us we should build our lands to stay; and departing, leave behind us fields that have not washed away. When our boys assume the mortgage on the land that's had our toil, they'll not have to ask the question: "Here's the farm, but where's the soil?"

There is plenty of interest in erosion which has had, likewise, plenty of publicity of late. Prof. Ayres' book is an effort to cover the problem most thoroughly, and he has done a good job. Engineering takes the front rank in his text, as it should, because erosion control is so largely an engineering problem. The factors affecting the rate of erosion and the methods of control are covered in 63 pages; rainfall and runoff in 17 pages. Other chapters of interest are those on gully control and dams.

Engineers will be particularly interested in the space devoted to a discussion of the retarding effects on runoff and erosion of the various kinds of vegetation, including forests. This contains a rather clear distinction between large and small water sheds; and, of course, the control of soil erosion is based primarily on the latter. He cites the work of Bates and Henry at Wagon Wheel Gap, Colo., where denudation was found to increase runoff 15% and flood flows 58%.

The section of rainfall and runoff is well presented but brings the engineer little that is new, except some good data on the coefficient of runoff for various types of small areas and similar data on time of concentration for areas of 1000 acres and less.

Legal Aspects of Milk Control:

By James A. Tobey, Dr. P. H.; published by International Association of Milk Dealers, Chicago, Ill. 100 pp.

Milk is one of our most important foods and legal control of its quality is well established. The reasons for such control, the regulation by the state and by the municipality, licenses, fees, permits and standards are covered in the opening chapters of this excellent little book. Inspection and sanitation of milk, tuberculin testing, pasteurization and containers for milk are other chapters. Particularly interesting and valuable from the practical point of view of the field sanitarian is the information on the sale of "loose milk," and the discussion on bottles, caps and bottle ownership. The final chapter has to do with liability in connection with dairy products. The book throughout is written from the legal viewpoint and the many references to cases and decisions will be of real value to those charged with the enforcement of milk regulations.

Water Purification Control

By Edward S. Hopkins, Principal Sanitary Chemist, Bureau of Water Supply, Baltimore, Md. Second Edition; 176 pp., 48 illustrations. Williams and Wilkins Co., Baltimore, Md. \$1.75.

This is the second edition of Mr. Hopkins' valuable little book. This tells in the language of the filter plant operator why and how to do certain things. We

believe that every water purification plant operator ought to have a copy of it.

The real discussion starts with coagulation, and covers mixing, time of mixing, floc characteristics, pH control, color removal and coagulation control. There are 48 pages devoted to this general subject. Then comes a discussion on sedimentation and settling. Very valuable are the 34 pages devoted to filtration. Washing filters is discussed critically and troubles, their causes and remedies, considered at some length. The information on mud ball formation should be valuable to all operators.

Disinfection, taste and odor causes and control, corrective treatment of waters, and softening are other subjects to which chapters are devoted. A good many operators ought to study the section on plant control data, in which is emphasized the necessity for keeping adequate records.

PERSONALS

Cecil K. Calvert, superintendent of the Indianapolis sewage disposal and garbage reduction plant for the past eleven years, has been appointed chemical engineer of the Indianapolis Water Company. Mr. Calvert will fill the position recently resigned by Harry E. Jordan who assumes the secretaryship of the American Water Works Association. Prior to his connection with the city's sanitation system, Mr. Calvert had worked for the Indianapolis Water Company for more than twelve years as assistant chief chemist with supervision over water treatment and filter plant operations.

R. S. Taggart, B.S. in C.E., who has served the Westchester county, N. Y., department of health as sanitary engineer since 1931, has resigned to become district sanitary engineer of the N. Y. State Department of Health. Walter M. Scott, B.S. in C.E., of Mt. Vernon, New York, has received provisional appointment to Mr. Taggart's former position.

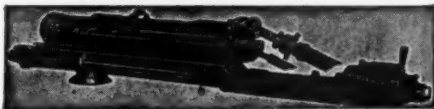
A. W. Erickson:

Mr. Erickson, who passed away November 2, combined advertising skill and executive ability to a marked degree. Early in his business career he established his own advertising agency and one of his first clients was the Barrett Co., whose product—Tarvia—has been advertised in this magazine for 30 consecutive years. His ability to sense the selling points of a product and present them to the market convincingly through type and pictures soon attracted other clients.

In the early period but after the advertising had been placed with him, he bought stock in some of these corporations and became an active member of the boards of directors. Several years ago the A. W. Erickson Co. and H. K. McCann Co., another advertising agency of equal importance, were combined, forming McCann-Erickson, Inc., and Mr. Erickson was chairman of the board and an active executive of that advertising agency until pneumonia ended his life.

An Automatic Feed Drill

In place of the conventional hand feed on the Chicago Pneumatic Tool Co. drills, the autodrifter is now available. This provides a small completely automatic unit that feeds the drill into the



CP Autodrifter

hole. This leaves the operator free to do other work while the drilling is in progress. It is said to be easier and cheaper than hand work. The CP-60 Autodrifter unit is shown herewith. Further information from the manufacturer at 6 East 44th St., N. Y.

Rocky Mountain Section, A. W. W. A., and Rocky Mountain Sewage Works Ass'n

At the A.W.W.A. meeting, it was voted to: License water superintendents and plant operators; to form a Rocky Mountain Sewage Works Section, and to hold meetings at the same time as the Rocky Mountain Water Works Section Meetings.

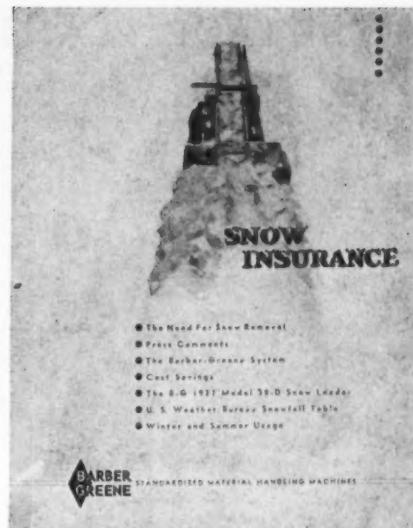
The officers of the Section who were nominated and duly elected at the business session, were as follows: Paul S. Fox, Public Health Engineer, chairman, Bureau of Public Health, Santa Fe, N. M., succeeding D. D. Gross, Denver Board of Water Commissioners. B. V. Howe, State Sanitary Engineer, secretary-treasurer (re-elected), State Office Bldg., Denver, Colo. Trustees: J. P. Soderstrum, City Manager, Grand Junction, Colo., succeeding O. J. Ripple, Supt. of Filter Plant, Board of Water Commissioners, Denver, and B. G. Coy, City Engineer, Ft. Collins, Colo., succeeding Milton Seaman, Water Supt., Greeley, Colo. A.W.W.A. Director: Chester S. Truman, Supt., Northfield Land & Water Co., Colorado Springs, Colo., succeeding L. C. Osborn, City Engineer, Loveland, Colo.

The officers for the Rocky Mountain Sewage Works Association were elected as follows: R. W. Gelder, Consulting Engineer, Greeley, Colo., president, and D. E. Kepner, Water Works Equipment, Denver, secretary-treasurer. Directors: Chas. A. Davis, Denver City Sanitary Engineer for one year, and L. O. Williams, State Sanitary Engineer, Cheyenne, Wyoming, for two years. Representatives for the Federation are: L. C. Osborn, City Engineer, Loveland, Colo., one year, and J. W. McCullough, Cons. Engr., Denver, Colo., for two years.

National Paving Brick Association

The thirty-first annual meeting of the National Paving Brick Association will be held at Detroit, Michigan, January 27, 28 and 29, 1937, at the Book-Cadillac Hotel. Most of the sessions will be open to the general public and those interested in street and highway development are invited to attend. In addition to the business sessions of the Association, the program, now under preparation, will consist of papers and discussions by engineers and contractors on the use of paving brick. The Research Bureau maintained by the National Paving Brick Association at the Ohio State University Experiment Station will present a resume of its work and there will be reports on recent researches on fillers, bed courses and methods of laying brick which include both laboratory and service tests.

The latest information on design and construction methods that have increased the skid-resistant qualities of brick pavements will be presented as a significant contribution to the highway safety movement. The relationship of brick pavement construction and relaying to unemployment relief and the increasing utilization of brick for resurfacing and reclaiming old pavements and bases will also be a prominent feature of the program. O. W. Renkert, Metropolitan Paving Brick Company, is President, and George F. Schlesinger, former Director of Highways and Public Works of Ohio, is Chief Engineer and Secretary of the National Paving Brick Association.



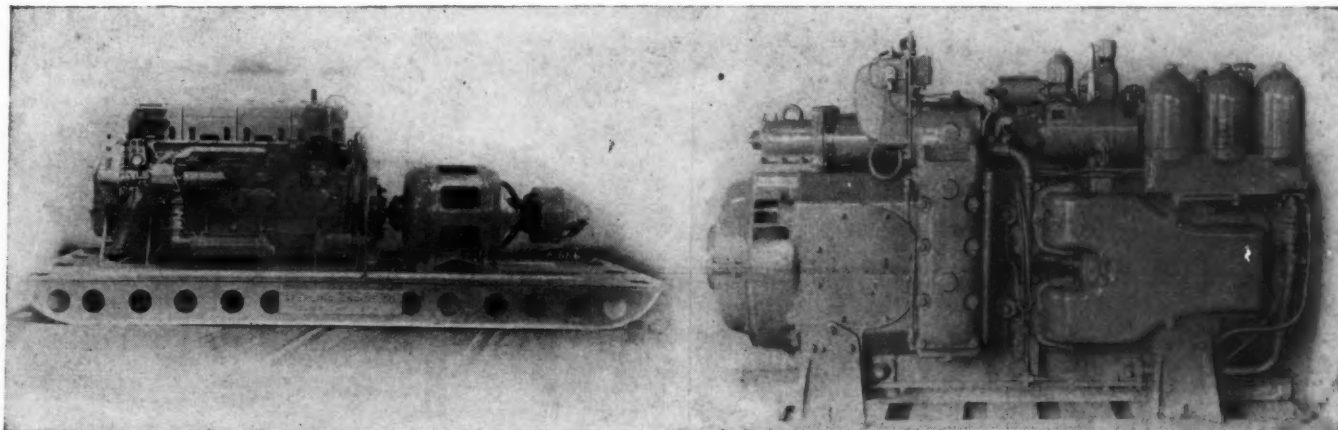
Barber-Greene Snow Loaders

Most everyone realizes that prompt and efficient snow removal is an essential part of our modern life—essential to meet the demands of business, safety and health. The new Barber-Greene snow loader is designed to take its place as one of the modern tools that makes efficient and rapid removal of snow possible. The catalogue illustrated herewith describes this new loader, and also gives considerable other information of interest to those charged with snow removal.

This Barber-Greene loader is, of course, designed for city snow removal work. On such work it will load 10 cubic yards a minute of snow, keeping trucks always on the move, and by means of a shuttle discharge trucks are loaded without backing under the loader.

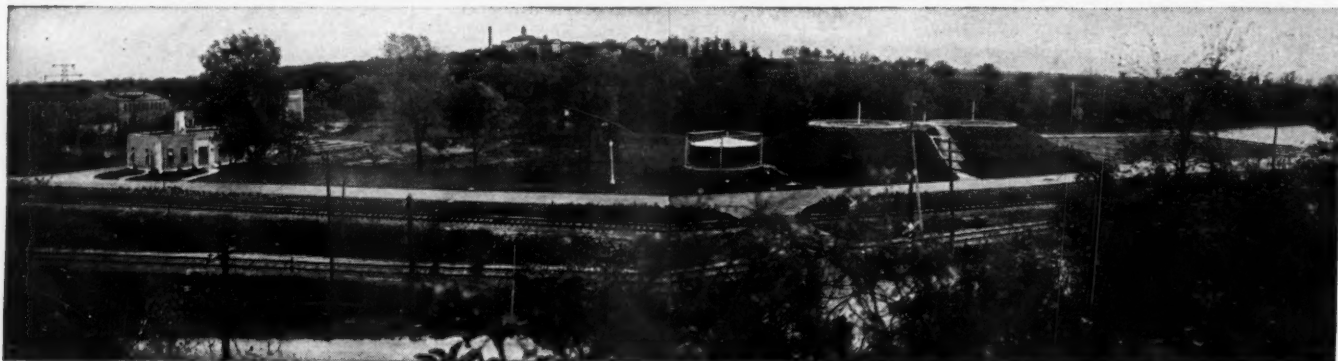
Another advantage of this machine is that it is easily convertible into a bucket-loader for non-winter use—in which capacity it will load all bulk materials, such as sand, cinders, gravel, crushed stone and earth.

We believe our readers interested in snow removal will find much of interest in this new catalog, which can be obtained by writing Barber-Greene Co., 635 West Park Ave., Aurora, Ill.



At the left is a 250-kw generator set, consisting of a 400-hp straight 8-cylinder Sterling gas engine (at 900 rpm) direct connected through flexible couplings to a 250-kw generator. At the right is a Sterling crankless, oil burning, combustion ignition, opposed piston engine. The three dome-shaped units are Purolator oil filters. Engine is supercharged. This is a 4-cylinder, 50-kw engine at 1,200 rpm. Also made in 75-kw size.

(SEWAGE PLANTS TO BE PROUD OF)



JANESVILLE, WIS.

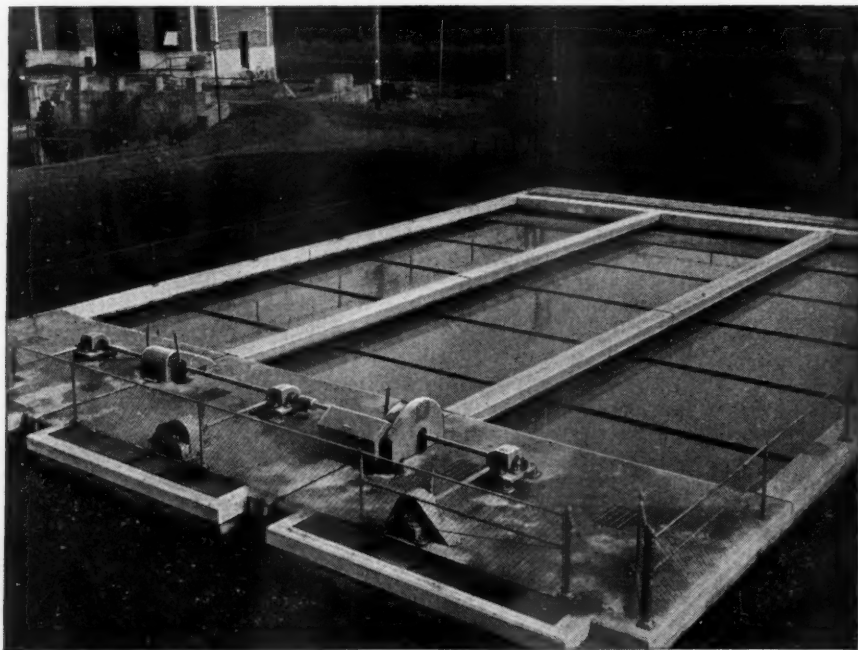
Joseph Lustig, City Engineer

A few years ago there were not many like it; although there were many superintendents to be proud of for obtaining as good results as they did with the facilities available. What a difference the introduction of mechanical equipment has made!

This modern, efficient, separate sludge digestion type of plant serves a population of 21,000 people. It was designed for a flow of 3 M. G. D. using primary digestion tanks with two hours detention. These primary tanks are each equipped with Link-Belt Straightline collectors which keep them continuously free of stale sludge—dependably and efficiently performing this unpleasant task with a minimum of agitation. Let us tell you about other Link-Belt installations.

Link-Belt Company, Philadelphia, Chicago, Los Angeles, Toronto.

5695



LINK-BELT

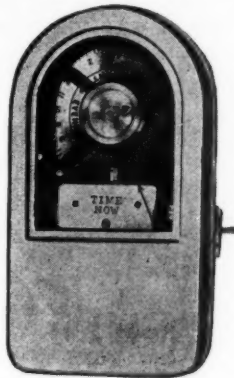
Screens - Collectors - Aerators - Grit Chambers - Diffusers

For Special information, consult the classified Readers' Service Dept.—pages 51-53.

NEW EQUIPMENT

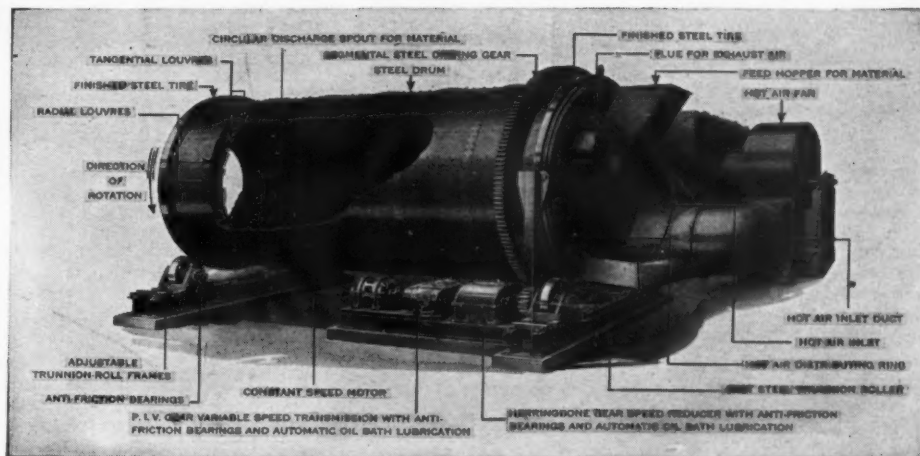
Clock Control of Electrical Circuits

The daily automatic control of electrical circuits is universally possible with the new Little Giant Tork Clock just announced by the Tork Clock Company of Mount Vernon, New York. It operates without winding or regulating



Tork clock control.

and may be quickly set on variable schedules. Simplicity in design effects a quick make and break action with pure silver contacts with nearly 50% less parts than formerly used. The twenty-four hour day is divided into four sections of six hours each covering morning, afternoon, evening, and night. The device has 5,000 watts capacity for either single or double pole service and is housed in a cadmium-plated case with unbreakable window. A large wireway and five plug buttons facilitate installation; weighs only three pounds.



The illustration above gives much data on this new Link-Belt dryer, which is suitable for drying all kinds of granular materials, and also sludge. Ask for Book 1511. Link-Belt Co., 307 North Michigan Avenue, Chicago, Ill.

pH-Redox Meter

The Series 3 Coleman Electrometers are light weight, portable precision instruments for the determination of pH and Redox in field, factory or laboratory. Accurate determinations of either pH or Redox can be made with less than 3 ml of sample with the regular electrode assembly while special micro assemblies are also offered. Means are provided for compensating both temperature and asymmetry potentials by calibrating against a known buffer. Because of the electronic amplifier micro Redox electrodes cannot polarize, allowing routine oxidation-reduction tests under conditions usually considered impossible.

Model 3A reads directly in pH and offers a practicable answer to a rapid and accurate means of determining pH anywhere.

Model 3C reads both pH and Millivolts, allowing the determination of Redox as well as pH with maximum accuracy and simplicity.

Descriptive literature and information

can be obtained by writing to the Coleman Electric Company, 318 Madison Street, Maywood, Illinois.

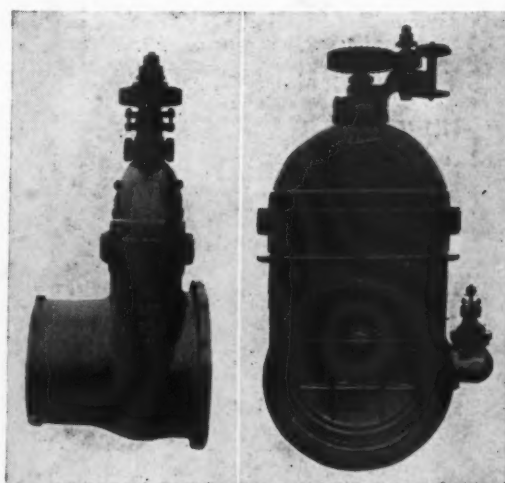


A new flexible shaft equipment for concrete finishing recommended for grinding and grouting operations on buildings, bridges, culverts or wherever large concrete surfaces are to be finished. Full data on request. R. G. Haskins Co., 4636 W. Fulton St., Chicago.

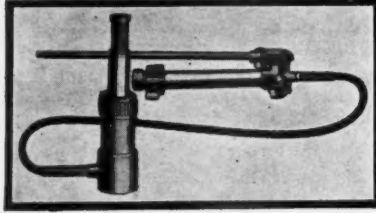
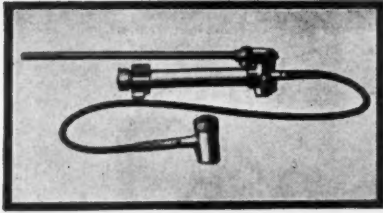
A Pair of Big Valves



The Coleman pH Meter



The valve at the left is a 20" geared tapping valve, and the one at the right a 30-inch geared valve with a 4" by-pass. These were furnished for the city of St. Louis, Mo., Thos. J. Skinker, engineer in charge of distribution, St. Louis water division, by the M. & H. Valve and Fittings Co., Anniston, Ala.



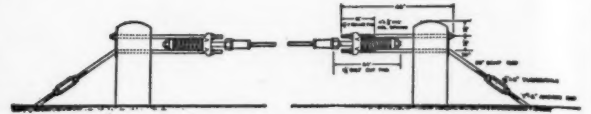
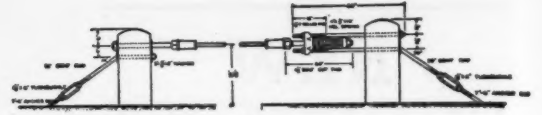
Here are two new jacks that should be of real interest to truck operators and owners. The "shorty" jack, shown at the left, is made for close work on frames and under fender wells. The "toughy" jack, shown in the other illustration, is for heavy work of all sorts. Remote pumps at the end of the cable permit the jacks to be worked without crawling under.



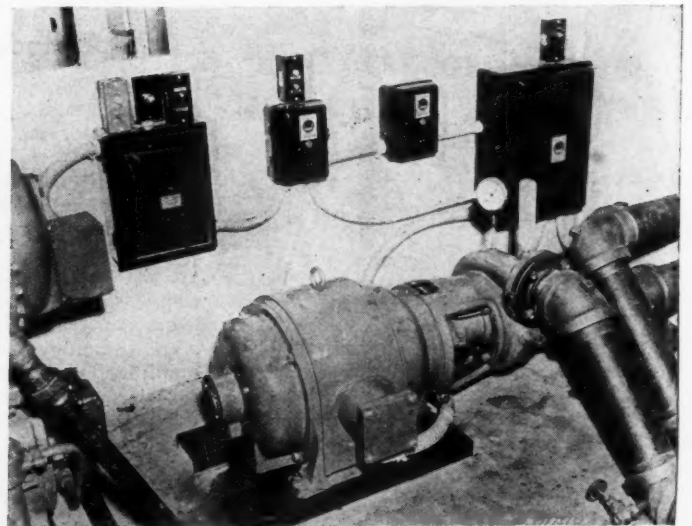
This shows the operating mechanism of the new Link-Belt speed-o-matic control for their shovels, cranes and draglines. It is said by users that this new control eliminates operator fatigue and results in speedier operation and greater output.



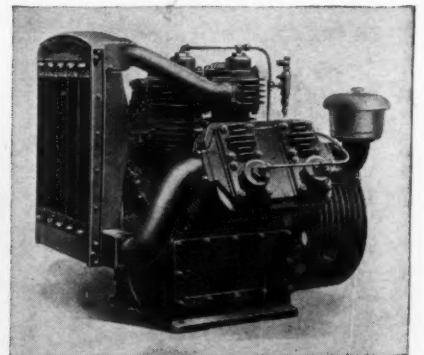
This is one of the units of the Shawano Co., Wisc., highway department. It is a FWD truck equipped with a bituminous distributor. The outfit is shown applying road oil to a county highway.



The super-guard, which is shown properly installed in the above illustrations, is a guard fence for high-speed traffic. It is designed to hold any bus, truck or automobile, when installed properly. There is never any slack. Interesting data and complete description are available from the Wej-Lock Co., Centralia, Mo. Write for information.



On the job down in Texas at the Centennial Exposition in Dallas. This Westinghouse splash proof motor drives a water pump for air-conditioning. On the wall are motor starters with remote controls above the starters.



This is a vertical angle, 2-stage air-cooled compressor. Made in 3 and 6 cylinder types. The 3-cylinder unit has two low-pressure cylinders set opposite, with a vertical high-pressure cylinder in the middle. The 6-cylinder unit is shown above, the high-pressure cylinders being vertical. This unit is compact and efficient, and suitable for use with a variety of drives. Descriptive bulletin No. L-620-B66 sent on request to Worthington Pump & Machinery Corp., Harrison, N. J.

These booklets are
FREE to readers of
PUBLIC WORKS.

at lower cost are described in a new bulletin just issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

Cast Iron Sewers

385. For use in wet ground to prevent infiltration, for crossing under railways and heavy duty highways, and for all other sewer construction where replacement, repairs or reconstruction would be costly, cast iron pipe is most economical. For details, specifications, etc., write Thomas F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Glass Covers

393. Full details regarding the use of Lord & Burnham Glass-Covers at Middletown, N. Y.; Marion, Ohio; Cleveland, Ohio; Freeport, N. Y.; Kitchener, Canada; West Chester, Pa., and other places are given in bulletins 22 to 33. Sent promptly on request to Lord & Burnham Co., Irvington, N. Y.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1 1/4 to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Concrete

408. Concrete Pipe Sewers, a 28-page booklet, contains much valuable information and numerous illustrations on concrete pipe. Issued by American Concrete Pipe Association, 33 West Grand Ave., Chicago.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineraloid, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

412. How, when and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

413. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

415. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Rubber Lined Pipes and Pumps

418. New, 68-page catalog describes Ace rubber lined pipe and fittings, hard or soft rubber lined centrifugal pumps and Ace hard rubber double acting pumps, for chemicals used in treating sewage and water and for acids and other corrosive liquids. Contains illustrations and specifications. Issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Loughlin, self-cleaning travelling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of the "Straight-line Bar Screen" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

429. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

430. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Sludge Bed Glass Covers

432. Sludge Bed Glass Covers—"Super-Frame." Hiltchings & Co., Elizabeth, N. J. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hall insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 247 Park Ave., New York, N. Y.

Thawing Equipment

460. Complete details concerning this quick-acting, efficient, electric pipe thawer which sells for only \$39.25, complete will be sent promptly by Commonwealth Mfg. Corp., Dept. P-710, 3785 Beachmont Ave., Cincinnati, Ohio.

For the Engineer's Library

The editors will be glad to assist readers in getting copies of publications mentioned here.

Sewage Treatment for Small Municipalities:

This bulletin, so the publishers say, contains design data for mechanical aerators that has never before been published. It is data that engineers must have to design activated sludge plants with mechanical aeration, properly and without guesswork. There is a table for selection of tanks, with quantities of concrete for aerators and clarifiers. There are also actual plans, layouts and bases of design for activated sludge plants for towns from 750 to 3500 population. Ask for Bulletin 128K, which will be sent on request to Sewage Equipment Division, Chicago Pump Co., 2338 Wolfram St., Chicago, Ill. Certainly worth a place in your files.

Flow Meter Engineering Handbook:

This is a fine book, and worth the \$2 it costs. It gives complete information on orifice design steam flow and water flow measurements, other liquid flow and air and gas flow measurement. It covers principles, design, application and installation, and all types of fluid measuring apparatus. Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa.

Screenings Shredder:

A new catalog on the "Rex Triturator" or screenings shredder, 8 pp. Among the features of this shredder are said to be: Practically no vibration; 350,000 blade cuts per minute; small motor and low power consumption; low water consumption; and long life. Quite fully described in Bulletin 289, which will be sent on request to G. H. Pfeifer, Chain Belt Co., Milwaukee, Wisc.

For the Constructor:

A new, twenty-four page bulletin, WP-1061, showing their equipment for construction work, is available from Worthington Pump and Machinery Corporation, Harrison, New Jersey. This bulletin shows power, compressed air, drilling, pumping, and miscellaneous equipment on the job and in the shop. Photographs show Worthington feed-drifters on tunnel work; wagon and rock drills on open cut work; portable compressors furnishing power for various operations; Worthington portable compressors, Rock Masters, and other equipment on highway and street construction; stationary compressors furnishing air for construction work; small compressors for occasional service; Diesel and gas engines furnishing power for dredging and other construction operations; pumps for drainage, dewatering, and dredging operations; portable pumping units and heat treating machines for drill steel.

Mixflo Pumps:

An eight-page bulletin illustrating and describing the improved Mixflo centrifugal pump has been issued by the Worthington Pump and Machinery Corporation, Harrison, New Jersey. The Mixflo, in sizes from 12 to 84 inches, delivers from 1000 to 225,000 gallons per minute at heads from 5 to 50 feet. It is used for irrigation, drainage, sewage disposal and condenser circulation service. Photographs, sectional drawings and dimension tables are included in the bulletin.

Telemeters and Automatic Controls:

"Power Plant Measuring Instruments, Telemeters and Automatic Controls" equipment for power-plant measurements and controls are shown and described in compact yet remarkably complete form. Specific applications are mentioned—in electrical generation and transmission, in steam generation and distribution, in hydro-power generation and in Diesel power generation—in which this equipment is being used to safeguard operation and to effect operating economies. Ask Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, Penna., for Broadside 160.

Electric Machinery Catechism:

Forty-eight pages, published by Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago.

This pamphlet is designed to answer questions that arise in the minds of individuals who use electrical equipment and who do not have an extensive formal knowledge of electrical phenomena and terminology. It is well illustrated and clearly written. The scope of the discussion is illustrated by the fact that one hundred and forty-four topics are considered and indexed.

Salt Stabilized Roads:

Three manuals are available: Recommended specifications for base and wearing courses, mimeographed and illustrated, 8 pages; base courses for bituminous surfacing, mimeographed and illustrated, 8 pages; construction manual for base and wearing courses, mimeographed and well illustrated with construction pictures, 24 pages. Together these form an excellent library on salt stabilized roads. Sent on request to Salt-Soil Road Bureau, Morton Salt Co., Hutchinson, Kansas.

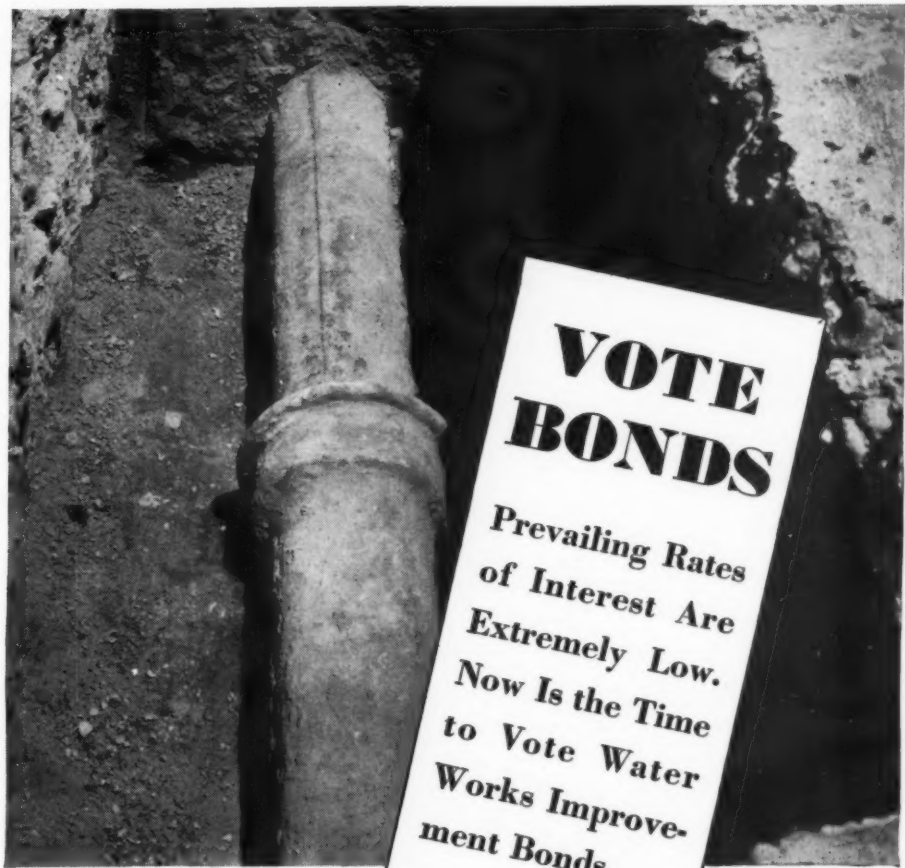
Solution Feeder Data:

Phipps and Bird, Inc., 915 East Cary St., Richmond, Va., have issued a photostated folder on the operation of their solution feeder, with illustrations and details of preparation of solution, making orthotolidine tests, etc. Sent on request.

Index to Advertisements

Activated Alum Corp.....	29
Alvord, Burdick & Howson.....	47
Atlas Mineral Products Co.....	28
Barber-Greene Co.....	3
Barrett Co.....	Front Cover & 5
Barstow & LeFeber.....	47
Black & Veatch.....	47
Browne, Floyd G.....	47
Buffalo-Springfield Roller Co....	37
Burns & McDonnell Engr. Co....	47
Caird, James M.....	47
Cast Iron Pipe Research Assn....	55
C., H. & E. Mfg. Co.....	48
Commonwealth Mfg. Corp.....	28
Cramer & Sons, Robert.....	47
Dow, A. W., Inc.....	47
Dresser Mfg. Co., S. R.....	27
Everett, Chester M.....	47
Everson Manufacturing Co.....	29
Ford Meter Box Co.....	33
Friez & Sons, Inc., Julien P.....	31
Frink, Mfr., Carl H.....	8
Fuller & McClintock.....	47
Greeley & Hansen.....	47
Green Co., Howard R.....	47
Gruendler Crusher & Pulverizer Co.	33
Harrub Engineering Co.....	47
Hill, Nicholas S., Jr.....	47
Industrial Chemical Sales Co....	25
Jaeger Machine Co.....	37 & 39
Jensen, Bowen & Farrell.....	47
Koehring Co.....	35
Layne & Bowler, Inc.....	29
Link Belt Co.....	46
Lord Baltimore Hotel.....	39
Lord & Burnham Co.....	31
M & H Valve & Fittings Co....	28
Mall Tool Co.....	48
Manual of Sewage Disposal Equipment	32
Metcalf & Eddy.....	48
Mohawk Asphalt Heater Co....	39
Munsell Concrete Vibrators....	37
Norton Company.....	4
Pacific Flush Tank Co.....	31
Page Steel & Wire Div.....	35
Pirnie, Malcolm.....	48
Potter, Alexander.....	48
Quinn Wire & Iron Works.....	31
Roberts Filter Mfg. Co.....	33
South Bend Foundry Co.....	33
Standard Oil Co. (Ind.).....	6
Standard Oil Co. of N. Y.....	2
Sterling Engine Co.....	27
Taylor, Henry W.....	48
Wallace & Tiernan Co....	Back Cover
West Steel Casting Co.....	48
Whitman & Howard.....	48
Wiedeman & Singleton.....	48
Wilson Engr. Co.....	48

Stage coach travelers saw this pipe laid 106 years ago



Section of cast iron water main in perfect condition after serving the City of Richmond since 1830 when travel in Virginia was by stage coach.

THE citizens of Richmond, Virginia, who town the municipal water supply system, have reason to be proud of the investment foresight of their ancestors who put down this cast iron water main more than a century ago. Its long life has saved the City considerable money in replacement, street excavation and pavement repairs. When recently uncovered for inspection, this cast iron main "looked" good enough to go on forever. No other water main material can match the service records, low maintenance charge and low investment cost

per service year of cast iron pipe. Our largest cities use it almost exclusively. Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS



RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

SAVING TOMORROW'S TAX DOLLAR



Micrometric accuracy is insisted upon for the control parts of W&T equipment.
A W&T inspector checking a part for a Visible Vacuum Chlorinator

THE CHLORINATION DOLLAR MUST BUY...ACCURATE CONTROL

TOO LITTLE chlorine in the treatment of water or sewage is useless,—too much, wasteful and unnecessary. To adequately perform its important task, chlorination must be accurately controlled.

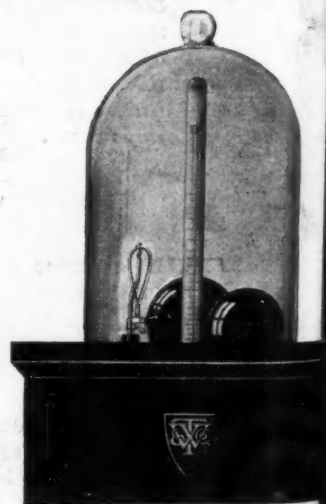
Every part of the W&T Visible Vacuum Chlorinator is built to a painstaking standard — every detail of design, calibration and manufacturing is checked and rechecked to insure accuracy over years of service.

Visit a nearby installation. Notice the simplicity, ruggedness and fine workmanship. Note the absence of delicate parts or diaphragm valves — the ease of dismantling for cleaning or adjustment.

You'll no longer wonder why leading engineers and sanitarians everywhere endorse the W&T Visible Vacuum Chlorinator — nor why unfailing accuracy is the record of each installation.

Because of its low maintenance costs, tomorrow's taxpayers will also endorse your choice — if you specify Visible Vacuum Control.

Technical Publications 38, 157 and 158 are yours for the asking



WALLACE & TIERNAN CO. Inc.

Manufacturers of Chlorine and Ammonia Control Apparatus

NEWARK, NEW JERSEY • BRANCHES IN PRINCIPAL CITIES

THE ONLY SAFE WATER IS A STERILIZED WATER

R

LA

TE